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ABSTRACT

To determine the influence of typewriting on selected language arts skills and motor development of the educable mentally retarded (EMR), the study investigated the academic achievement of such students in reading, vocabulary, spelling, and in motor skill development resulting from the use of the typewriter and specially prepared typewriting materials. Control and experimental groups consisted of 30 EMR students each. For 8 weeks students were taught touch typewriting, then for 20 weeks received instruction in language arts skills in addition to regular reading lessons. The experimental group completed the programed exercises on electric typewriters, while the control group completed them by writing with pencil or pen. Pre- and posttests were administered. Adjusted mean scores of the experimental group were higher in reading, spelling, and in 10 of the 14 motor development subtests (in two of which statistical significance was attained). No significant differences in vocabulary performance were noted. Positive attitudes toward typewriting were observed to be strong. Appendixes are contained in Volume II (EC 031 255). (KW)

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VOLUME I

THE INFLUENCE OF TYPEWRITING ON SELECTED LANGUAGE ARTS SKILLS AND MOTOR DEVELOPMENT OF THE EDUCABLE MENTALLY HANDICAPPED

Sister Mary Paulette Gladis
University of North Dakota
Grand Forks, North Dakota

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August 1970

Department of Health, Education, and Welfare

U.S. Office of Education
Bureau of Education for the Handicapped

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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THE INFLUENCE OF TYPEWRITING ON SELECTED LANGUAGE ARTS SKILLS AND MOTOR DEVELOPMENT OF THE EDUCABLE MENTALLY HANDICAPPED

by

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Bachelor of Arts, Fontbonne College 1962

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A Dissertation

Submitted to the Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Grand Forks, North Dakota

August
1970

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ABSTRACT

Statement of the Problem

The problem of this study was to determine the influence of typewriting on selected language arts skills and motor development of the educable mentally handicapped. Specifically, it was an investigation of the academic achievement of the educable mentally handicapped in reading, vocabulary, spelling, and of motor skill development resulting from the use of the typewriter and specially prepared programmed typewriting materials.

Procedure

To realize the objective of this study, the Pretest-Posttest Control Group Design was utilized. Sixty educable mentally handicapped pupils were selected from the population currently enrolled in the Special Education Program of the Archdiocese of St. Louis, Missouri; thirty were randomly assigned to the experimental group, thirty to the control group. Appropriate variables were controlled statistically by the application of covariance. Four subjects were eliminated from the study; fifty-six pupils completed the experiment.

Special programmed typewriting materials based on the linguistic approach were developed for this study. They were designed to supplement a reading series currently in use in the Special Education Program in which the study was conducted.

The investigation was undertaken in nine special education classes

in the Special Education Program of the Archdiocese of St. Louis, Missouri, for twenty-eight weeks, during the fall and spring semesters, 1969-1970. The study was conducted in two phases: phase one was the first eight weeks, during which pupils were taught a modified system of touch typewriting; phase two followed for twenty weeks, during which subjects participated in the language arts typewriting program. Each group received forty-five minutes of instruction daily in the selected language arts skills in addition to their regular reading lesson. Subjects in the experimental group used standard electric typewriters to complete the programmed exercises, subjects in the control group completed them in the traditional manner; that is, by writing or printing with pencil or pen.

The measuring instruments used in this study were: Metropolitan Achievement Test, Form A (pretest) and Form B (posttest); Lincoln-Oseretsky Motor Development Scale; and an adaptation of a straight-copy typewriting test published by the United Business Education Association.

The data derived from the measurement of pupils on pretests and posttests were treated statistically through the use of analysis of covariance to determine the significance of change.

Attitudes toward the typewriting program were determined by means of an appraisal submitted by parents of subjects in the experimental group, written evaluations of the participating teachers, discussions with the teachers at conferences held during the study, letters from the pupils, and case studies.

Findings

1. The adjusted mean scores of the experimental group exceeded those of the control group in reading, spelling, and in ten (71 per cent)

of the fourteen motor development subtests, although statistical significance was attained in only two motor subtests.

2. There was no significant difference between the performance of the experimental and control group in vocabulary.

3. Subjects in the experimental group acquired a modified touch typewriting skill as measured by an adaptation of a straight-copy typewriting test published by the United Business Education Association.

4. Many intangible and statistically nonmeasurable psychological findings were reported by parents, teachers, and pupils, and were observed by the investigator and the consultants for this study. Among the psychological factors associated with this study, it was found that the positive attitudes toward typewriting were stronger than the aptitude revealed by the statistical analysis of the data.

Conclusions

1. There appears to be a trend whereby the use of the typewriter may enhance the learning ability of the educable mentally handicapped in reading and spelling, and in the development of motor ability.

2. The educable mentally handicapped can acquire modified touch typewriting skill.

3. Regular special education teachers are able to teach modified touch typewriting to the educable mentally handicapped without special preparation in typewriting methodology.

4. The findings of this study seem to justify the recommendation that typewriting be included as a regular part of the special education curriculum.

5. Programmed instructional materials based on the linguistic approach appear to be appropriate for teaching language arts typewriting.

CHAPTER I

THE PROBLEM

Introduction

> The blind had their Helen Keller . . . the deaf had Beethoven . . . . Among retarded persons, there is none who, through his achievements, could demonstrate to the public his value and the value of those similarly afflicted. It is up to us, then, to uphold the value of these human beings (Egg, p. 151).

This study is an attempt to answer the plea sounded by Dr. Maria Egg, a German psychologist, and thousands of other psychologists and educators throughout the world, for effective educational methods to assist in enhancing the value of these retarded individuals.

The problem of teaching reading, vocabulary, and spelling, as well as that of improving the motor development of the educable mentally handicapped, has been a concern of educators for many years. The experience of most teachers of retarded children agrees closely with research reports that the children learn more slowly and retain less under conventional classroom pedagogy.

With greater cognizance of the nature and magnitude of these problems, there is a growing awareness that specialized methods of teaching must be developed if these children are to have optimum opportunity to learn. The mentally retarded appear to profit from teaching techniques and methods of instruction designed to meet the specific needs arising from their limited intellectual ability. Since their powers of retention are limited, greater reinforcement of learning through

repetition in many forms is essential. In this connection, Willey and Waite (p. 26) propound:

> The intellects of children develop only by what their eyes see, ears hear, noses smell, hands touch, and tongue tastes. The availability and nature of materials and equipment, the access to other children, the degree of health of the senses, all contribute to mental development.

An approach which has been relatively successful throughout the years, known as "The Kinesthetic Approach," was described by Montessori in 1912 and later made popular by Fernald and Keller. According to this method, one learns through associations he has with his own movements (Inskeep). Hebb's theory of learning concurs with this: By engaging more cortex; that is, by including the motoric portion of the brain, more opportunity is provided for interfacilitation (Benoit, 1964).

Accordingly, a relatively new application of the kinesthetic approach to the teaching of the mentally retarded has been undertaken in this study through the use of the typewriter and specially prepared programmed materials. Although additional research and experience is necessary before conclusions can be reached as to the most effective educational procedures for teaching the educable mentally retarded, it appears that the use of the typewriter provides the repetition and specialized type of experience necessary to maximize their learning ability.

Statement of the Problem

The problem of this study is to determine the influence of typewriting on selected language arts skills and motor development of the educable mentally handicapped. Specifically, it is an investigation of the academic achievement of the educable mentally handicapped in reading, vocabulary, spelling, and of motor skill development resulting from the use of the typewriter and specially prepared programmed typewriting

materials.

The hypotheses to be tested in this experimental study are:

1. There will be a significant difference in the adjusted means in posttest scores for reading between the experimental group and the control group as measured by the Reading subtest of the Metropolitan Achievement Test, using the pretest as a covariant.

2. There will be a significant difference in the adjusted means in posttest scores for vocabulary development between the experimental group and the control group as measured by the Word Knowledge subtest of the Metropolitan Achievement Test,

3. There will be a significant difference in the adjusted means in posttest scores for spelling between the experimental group and the control group as measured by the Spelling subtest of the Metropolitan Achievement Test, using the pretest as a covariant.

4. There will be a significant difference in the adjusted means in posttest scores for motor development between the experimental group and the control group as measured by selected subtests of the Lincoln-Oseretsky Motor Development Scale, using the pretest as a covariant.

5. The educable mentally handicapped can acquire a modified touch typewriting skill as determined by an adaptation of a straight-copy typewriting test published by the United Business Education Association.

Purpose of the Study

The purpose of this study is to measure the influence of typewriting on the academic achievement of educable mentally handicapped pupils in reading, vocabulary, and spelling, and on their motor development. As a subsidiary objective, it was anticipated that the pupils in this experiment would acquire a modified touch typewriting skill which may assist them to attain a prevocational skill. Furthermore, it is expected that the results of this study will demonstrate that the regular special education teacher can teach typewriting to the educable mentally handicapped

without highly specialized preparation in typewriting methodology.

This experimental study was concerned with teaching typewriting to the educable mentally handicapped through the use of specially prepared programmed typewriting materials developed according to the linguistic approach. These materials were based on one of the reading series currently in use in the Special Education Program of the Archdiocese of St. Louis, Missouri.

Need for the Study

Leading specialists in the field of mental retardation have expressed the need for exploring programs of education which will provide opportunities for the mentally handicapped to develop their potentialities. This need was reiterated by Goldstein and Mann (p. 48):

> . . . Our youngsters, by definition, cannot profit from the ordinary tracks of learning. We, therefore, must pioneer constantly to make their particular program not only different--but ever-related, ever-responsible, and ever-realistic.

At the national, state, and local levels, an increasing amount of effort is being expended on behalf of the more than six million mentally retarded persons in the United States. The neglect of these millions in the past has been a blot upon our commitment to the provision of equal opportunity for all. Robinson and Robinson (preface), noted psychologists and experts in the area of mental retardation, indicate that, "the mentally retarded in great numbers and in dire need, have remained until this decade among the most ignored and least regarded of all children."

It is of particular importance that a study be undertaken in which the learning process of the educable mentally handicapped be understood and that programs be undertaken to improve their lot. More than any other group of retardates, children in this category exhibit potential for successful membership in the society at large. Their handicaps are relatively

mild, they usually have no striking physical or cognitive disabilities other than low intelligence, and under proper circumstances they can learn a great deal which is useful to themselves and to others. Therefore, it seems to be of the greatest consequence to attempt to find ways to prevent their "intellectual stagnation, and to interrupt the cycle of generation after generation of inadequacy, defeat, and despair" (Robinson and Robinson, p. 221).

That the area of education for the mentally retarded is one which requires bold, creative thinking of ways in which to provide opportunities for the development of their potentialities is implicit in the statement by the late John F. Kennedy (p. 12), president of the United States: " . . . We as a nation have for too long postponed an intensive search for solutions to the problems of the mentally retarded. That failure should be corrected."

It has been fairly well validated that mentally retarded individuals do not read at expectancy level and are inferior to normal children in motor ability. Sloan, who studied the relationship between intelligence and motor proficiency, found that such a relationship exists--that mental defectives are inferior to children of average intelligence in motor proficiency. In this respect, Benton (p. 37) remarks that " . . . A genius can afford to be a 'motor imbecile' but a person with an I.Q. of 75 cannot. The latter's psychomotor ability may well determine whether he will attain a reasonable degree of social competence."

Sheperd, who reviewed and evaluated the major literature which contains implications for the education of the educable mentally handicapped, stresses the need for additional and more refined investigation in subject matter, learning abilities, and teaching procedures. It is toward the accomplishment of this goal that the present investigation of

the influence of the use of the typewriter by the educable mentally handicapped is designed.

Individual teachers of the mentally handicapped have used the typewriter as an educational tool, but they have not studied the effectiveness of this instrument. Monsignor Elmer H. Behrmann, Director of the Special Education Program of the Archdiocese of St. Louis, Missouri, has stated: "Almost every special education classroom as a typewriter which is used as an instructional tool. However, we do not know specifically to what extent it is used effectively in the educational program" (personal interview).

Commenting on the present investigation of typewriting for the educable mentally handicapped, Frostig, who developed a method of testing for perceptual disturbances and an educational program for young brain-injured children, had this to say:

> . . . I have the impression that your program involves training in many underlying skills (sensory-motor, perceptual, language, cognitive, social and emotional) in an integrated fashion and that your study will be an important contribution (personal letter).

See Appendix A, page 138, for a copy of Frostig's letter.

Although a number of studies have been conducted to demonstrate that children with average or superior intelligence can develop their academic skills significantly through the use of the typewriter, very little has been done for children who are at the opposite end of the mental ability scale, the educable mentally handicapped. The paucity of research data on the use of the typewriter as an educational tool for the mentally handicapped is striking; its results are fragmentary and have not been validated by replication. There are no studies which deal with typewriting for the educable mentally handicapped. No one has attempted to show the directed use of the typewriter for promoting the

learning process in this manner.

With the present emphasis upon combating mental retardation exemplified by the eighty-eight Congress, educators may wish to re-evaluate training programs for the educable mentally handicapped. The use of the typewriter may provide an untapped reservoir of resources in the educational development of the mentally handicapped.

This study, therefore, may have significance for educators who are sincerely interested in providing every available opportunity to improve the educational achievement of the mentally handicapped.

Delimitations of the Study

This study was delimited as follows:

1. Only samples of educable mentally handicapped children enrolled in the Special Education Program of the Archdiocese of St. Louis, Missouri, during the academic year, 1969-1970, were included in this study.

2. Only those pupils whose chronological age was between eight and fifteen were included in this study.

3. Only those pupils who had as a part of their school cumulative record a Revised Stanford-Binet, Form L-M, intelligence quotient score of not less than fifty-five nor more than eighty-five were included in this study.

4. Only those pupils whose educational achievement was at the first, second, third, and fifth grade levels were included in this study.

5. Only those pupils whose educational achievement was at the second, third, and fifth grade levels were measured for performance in spelling.

6. Only those pupils who were not of a special clinical type and who did not have observable indications of sensory-motor impairment (paralysis, deformities, history of seizures) were included in this study.

7. Only those pupils who were not receiving speech therapy were included in this study.

8. Only the alphabetic characters and the service mechanisms were included in the preliminary typewriting instruction in this study.

9. The daily 45-minute period of instruction was interspersed at various intervals according to the discretion of the individual special education teachers.

Limitations of the Study

This study was limited by:

1. The population of educable mentally handicapped children from which the sample was selected.

2. The quality of the special instructional materials.

3. The teacher differences in the nine special education classes in which the experimental and control groups received instruction.

4. The physical, mental, and emotional state of the pupils when they received instruction.

5. The physical, mental, and emotional state of the pupils when they were administered the pre- and posttests.

6. The influence of the "Hawthorne Effect" on pupils in the experimental group.

Definition of Terms

The following terms are defined as they apply to this study:

Archdiocese:	An administrative division of the Catholic school system.
Clinical Type:	Those children with physical and/or organic disabilities.
Educable Mentally Handicapped:	Those children with an intelligence quotient score ranging between fifty-five and eighty-five who are at least two years retarded in school achievement and who have learning difficulties with the regular school curriculum.
Educational Achievement Level:	The academic level at which the pupils have the ability to function with relative success as determined by educational achievement tests.

"Hawthorne Effect": The phenomenon whereby pupils, aware that they are taking part in an experiment, may improve their performance regardless of treatment.

Hebb's Theory: A neurophysiological theory which postulates the necessity for continuing input of a variety of perceptual experiences if the central nervous system is to function adequately.

Kinesthetic Approach: A theory of learning by which one recalls through associations with one's own movements.

Lincoln-Oseretsky Motor Development Scale: A standardized battery of tests of motor skills which may be used for educable mentally handicapped children.

Linguistic Approach: A method of teaching reading by which many different phonemic sounds are introduced systematically.

Metropolitan Achievement Test: A standardized battery of tests of achievement in reading, vocabulary, and spelling which may be used to determine the educational achievement level of the educable mentally handicapped.

Modified Touch Typewriting: The ability to use correct fingering in typewriting, identifying the keys by sight when necessary.

Motor Ability: The ability to control one's muscular movements.

Prestige Occupational Scale: A scale designed by the National Opinion Research Center by which a rating is assigned to each child's parental occupation to determine his socioeconomic status.

Psychometrist: A specialist in the science of measurement of the psychophysical processes.

Qualified Special Education Teacher: A teacher who has had professional preparation and experience in the education of the mentally handicapped.

Revised Stanford-Binet, Form L-M Intelligence Test: An individually administered intelligence test generally considered satisfactory in providing a prediction of intellectual capacity.

Wechsler Intelligence Scale for Children (WISC): An individually administered test which measures both verbal and nonverbal areas of performance, used to assess the intellectual potential of children.

Organization of the Chapters

This study is presented in five chapters: (1) Introduction; (2) Review of Related Literature; (3) Procedures; (4) Findings; and (5) Summary, Conclusions, and Recommendations.

Chapter I presents an introduction to the study, a statement of the problem, the purpose of the study, the need for the study, delimitations, limitations, definition of terms, and the organization of the chapters.

Chapter II contains a review of the literature related directly and indirectly to this study. Included in this chapter is a review of pertinent writings concerned with the historical development of education for the mentally handicapped; general characteristics of the educable mentally handicapped; learning characteristics of the educable mentally handicapped; motor characteristics of the educable mentally handicapped; special teaching methods, including typewriting, for the educable mentally handicapped; and typewriting for normal and gifted children at the elementary school level.

Chapted III details the procedures followed in this experimental study in the following sections: (1) Development of the Problem, (2) Schools, (3) Population, (4) Sample, (5) Teachers, (6) Materials,

(7) Equipment, (8) Orientation Workshop, (9) Method, and (10) Measuring Instruments.

Chapter IV describes the findings of this study in table and discourse form. Included in this chapter is a report of the statistical analysis of the data, attitudes toward typewriting for the educable mentally handicapped, progress records, and publicity about the study.

Chapter V contains the summary and conclusions of the investigation, and offers recommendations for action and further research based on the reported findings of this study.

The Appendices present the materials which were used for the purposes of instruction, information, and evaluation in this study, as well as detailed tables of raw scores and grade equivalents.

The Bibliography presents a listing of the published and unpublished materials which the researcher used in the development of this dissertation. These sources are categorized in alphabetical order.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of reviewing related literature was to locate, analyze, and interpret research and reports which are germaine to the problem under study. Because of the importance of understanding the characteristics and learning process of the educable mentally handicapped, extensive reference has been made to professional literature in the field of abnormal psychology. Although the literature pertaining to the influence of typewriting on the learning process of normal and gifted children is extensive, pertinent writings which relate to the teaching of typewriting to the educable mentally handicapped are few.

Related literature in this study is organized under the following general categories:

1. Historical development of education for the mentally handicapped
2. General characteristics of the educable mentally handicapped
3. Learning characteristics of the educable mentally handicapped
4. Motor characteristics of the educable mentally handicapped
5. Special teaching methods, including typewriting, for the educable mentally handicapped
6. Typewriting for normal and gifted children at the elementary school level

For the purpose of this study, it was found beneficial to review the general literature in each of the areas, and then to selectively cover the writings which are more specific to the interest of this study.

Historical Development of Education for the Mentally Handicapped

In reviewing the total context of history, it can be seen that great advances have been made in a relatively short time for the education of the mentally handicapped. "Professional services are less than 150 years old in Western civilization, and just over a century old in this country" (Dunn, 1964, p. 13). Prior to the nineteenth century, society's record was one of the "most pathetic chapters in the history of man" (Dunn, 1964, p. 14).

The history of mental retardation has not been thoroughly chronicled; however, the oldest written record of mental retardation is said to occur in the Therapeutic Papyrus of Thebes, 1552 B.C. The problem also engaged the attention of several Greek writers. It is noteworthy that both Hippocrates and Plato placed the seat of the soul in the brain, while Galen discussed variations in mental acuity. Aside from these contributions, however, the Greeks are remembered for their custom of either abandoning the children or "exposing their handicapped offspring to the elements to perish" (Doll, 1962, p. 23). The Romans are said to have added the custom of maintaining fools for pleasure. It is well known that the retarded of the Middle Ages were exploited as "fools" and "jesters" for the amusement of the lords and their ladies. During the Protestant Reformation, most people thought that handicapped persons were "possessed with the Devil," and, therefore, the common treatment was "to beat the Devil out of them" (Dunn, 1964, p. 14).

The spread of Christianity, with its "compassion for the unfortunate and downtrodden" (Doll, 1962, p. 23) provided one bright spot for the retarded prior to 1800.

> Most religions of the world emphasized compassion for the less fortunate. From the thirteenth century on, the churches of Europe began rather systematically to provide asylums for the less fortunate members of society, including the intellectually handicapped (Dunn, 1964, p. 14).

Treatment or education was not attempted, however, as the "asylums" were intended solely to provide a sanctuary for those unable to survive in a cruel and competitive society.

During the nineteenth century we find the beginnings of education for the mentally retarded. One of the first professional persons to enter this field was a French physician, Jean Itard, who attempted to educate Victor, the Wild Boy of Aveyron. For more than five years, Itard worked systematically and continually, attempting to lead Victor, who was diagnosed as an incurable idiot, from the life of a savage to that of a civilized person. Itard found that "if the reflective power in a person of low mentality is awakened by stimulation of the senses, this reflective power can be further developed" (Theodore, p. 164). Although Itard perceived his efforts as being in vain when Victor terminated the program by leaving in a rage, the French Academy of Science acknowledged the substantial contribution his effort had made to education. Students in the field of mental retardation consider it as the first scientific attempt to train a retarded person. It marked a radical change of emphasis from custodial care and incurability to treatment and education.

Itard's influence on the education of the mentally retarded was quickly felt elsewhere. He taught Seguin, who was perhaps one of the greatest teachers to address his attention to the mentally defective. Itard's influence extended to many others, including Montessori, who developed self-instructional devices.

Although the modern movement toward education of the mentally

retarded began with Itard and the Wild Boy of Aveyron, the diffusion of programs for the retarded was sporadic until the beginning of the twentieth century. The first special education class in America was established in 1896 in Providence, Rhode Island. In 1911, there were classes for the mentally retarded in ninety-nine American cities. In 1948, about 87,000 mentally retarded children were enrolled in special classes. Ten years later, enrollments had risen to about 213,000 (Farber). Since then, the rise has been even sharper. By 1967, about 677,000 mentally retarded children attended classes, not only in preschool and elementary school, but in high school as well (Mental Retardation 67: Report of the President's Committee on Mental Retardation, p. 6).

Thus have attitudes toward the mentally retarded progressed from total rejection by society, through imprisonment and ridicule, through a century of devoted care by a handful of professionals and philanthropists, to emerge as a major concern of psychologists, educators, and the government. "The present day is seeing increasing acceptance of the 'rights of the retarded' . . . the right of each to full realization of his potentialities" (Doll, 1962, p. 61).

General Characteristics of the Educable Mentally Retarded

Information concerning physical, intellectual, and emotional characteristics of the educable mentally handicapped is scarce. Johnson (1967 b) found that the most accurate information available concerns social backgrounds of the mentally retarded. Consistently reported in a number of confirmatory studies is the fact that a substantial majority of the educable retarded live in the lower socioeconomic cultural areas of the community. "The majority of the mentally retarded come from lower

class homes that provide a minimum of psychosocial and cultural stimulation" (Johnson, 1963 b, p. 478). The map on page 17 indicates percentages of the total school enrollment in classes for the educable mentally handicapped in metropolitan St. Louis, Missouri, as determined by the child's place of residence. This map illustrates graphically the fact that there are more children classified as educable mentally retarded living in urban poverty areas than there are living in the suburban sections (Mental Retardation 68: Report of the President's Committee on Mental Retardation, p. 18). The locations of the schools participating in this study are designated on the map by dots.

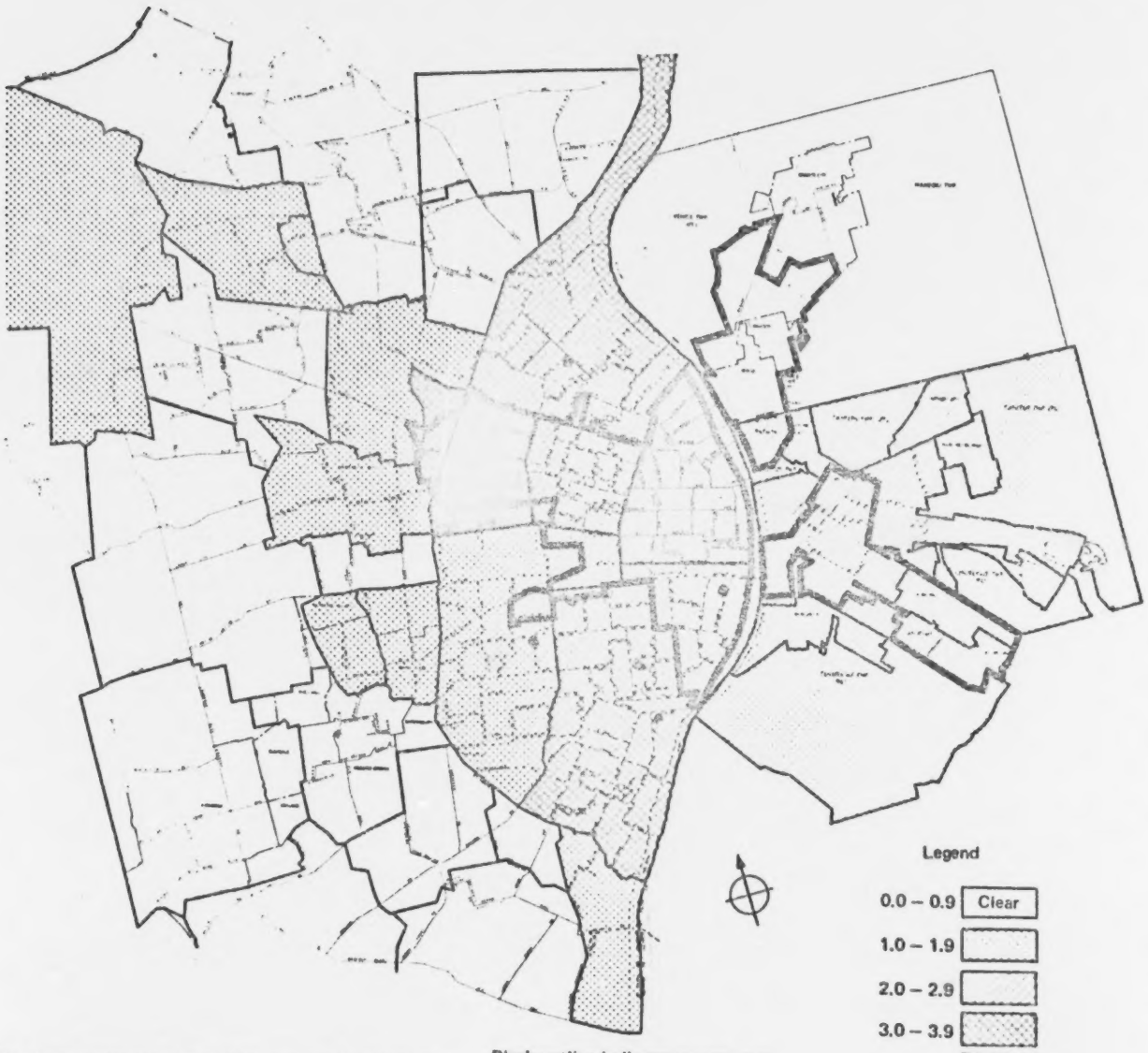
With regard to the physical and psychological characteristics of the mentally retarded, Johnson (1967 b) believes that statements about them are regarded as true merely because they have been repeated over and over again. Since there is a lack of agreement with respect to the characteristics of the mentally handicapped, particularly in the behavioral areas, this discussion will first be directed to a clarification of the terminology to be used.

There are, generally speaking, three classes of the mentally retarded:

1. Mentally deficient (trainable retarded), who have intelligence quotient scores ranging from thirty to fifty-five.
2. Mentally handicapped (educable retarded) who have intelligence quotient scores ranging from fifty-five to eighty-five.
3. Slow learners who have intelligence quotient scores ranging from eighty to ninety-five.

The American Association on Mental Deficiency published the following classification which measures intelligence levels according to the standard deviation units from the mean (Report of the Task Force on Education and Rehabilitation, p. 15):

THE EDUCABLE MENTALLY RETARDED
IN URBAN AND SUBURBAN AREAS



Map indicates percentages of total school enrollment in classes for the educable retarded in metropolitan St. Louis as determined by child's place of residence rather than where attending school. There are more children classified as educable mentally retarded living in urban poverty areas than there are living in the suburban sections. This pattern of poverty and mental retardation is repeated in map data prepared on Bridgeport, Los Angeles, Harrisburg and Seattle, and would be expected to be true of other major urban centers.[16]

Map developed by President's Committee staff, using school enrollment data supplied by school systems, 1968.

Fig. 1--Map of St. Louis, Missouri, Indicating Poverty Areas

TABLE 1

BEHAVIORAL CLASSIFICATION OF MENTAL RETARDATION AS CATEGORIZED BY AMERICAN ASSOCIATION ON MENTAL DEFICIENCY

Standard Deviation Units From the Mean	Level of Retardation	Intelligence Quotient Score
-1	Borderline	70-84
-2	Mild	55-69
-3	Moderate	40-54
-4	Severe	25-39
-5	Profound	0-24

The educable limits established by the State of Missouri are intelligence quotient scores from 48 to 78 "as a minor consideration" (The Education of Elementary Children Who Are of Retarded Mental Development).

These limits are set arbitrarily, since intelligence test scores in themselves do not entirely determine the particular level of deficiency. Furthermore, the children in each of the groups are not all alike. "They are not homogeneous groupings" (Hutt and Gibby, p. 54). Hutt and Gibby (p. 1) further note that "between the highest and lowest levels there is a very large range--a continuum which comprises all the intervening levels of intellectual capacity." There is no sharp division along this continuum. For convenience, we may term those who rank below some arbitrarily selected point as "mentally handicapped," just as we may term those who rank above some arbitrarily selected point as very superior.

Zigler (1966 a, p. 109), distinguished for his work on the behavior

of institutionalized retardates, asserts that "the decision as to whether a person is considered retarded is often based not upon his intellectual characteristics but upon legal and occupational factors as well as his general level of social adjustment." The matter has been stated succinctly by Maher (p. 238):

> What constitutes mentally retarded behavior depends to a large extent upon the society which happens to be making the judgment. An individual who does not create a problem for others in his social environment and who manages to become self-supporting is usually not defined as mentally retarded no matter what his test IQ may be. Mental retardation is primarily a socially defined phenomenon, and it is in large part meaningless to speak of mental retardation without this criterion in mind.

The recurring theme of the Conference on Problems of Education of Children in the Inner City, sponsored by the President's Committee on Mental Retardation and the Bureau of Education for the Handicapped, was that we now have what may be called a "6-hour retarded child"--"retarded from 9 to 3, five days a week, solely on the basis of an IQ score, without regard to his adaptive behavior, which may be exceptionally adaptive to the situation and community in which he lives" (The Six-Hour Retarded Child, Statement by Participant). Only in an academic environment do these children function at a retarded level.

Guskin observes that for many, the image of the mentally retarded includes: clumsiness, irresponsibility, sloppiness, carelessness, nervousness, timidity, reticence, and abnormality. Farber (p. 3) points out that these impressions are "often false and contradictory." However, he admits that "in the absence of systematic investigation by social and behavior scientists, one must rely on personal impressions based on limited experience."

According to Heber (1963), the term "educable mentally retarded" refers to a heterogeneous group of children who have in common:

1. General intellectual functioning which is below the average range of the general population

2. Predicted or demonstrated inability to cope with the regular school curriculum at the typical age

3. Potential for achievement of a minimal but significant level of basic academic skills when provided with a curriculum and teaching techniques appropriate to their level and rate of intellectual development

4. Potential for achievement of those social and occupational skills essential to independent adult living

Harlow (p. 157) summarizes the characteristics of the educable mentally retarded as follows:

1. An inability to meet average classroom behavioral expectations

2. An I.Q. which falls between 50 and 80 on an individual intelligence test

A factor frequently mentioned as characterizing the performance of the retarded is their high expectancy of failure. "This failure expectancy has been viewed as an outgrowth of a lifetime characterized by frequent confrontations with tasks for which the retarded are intellectually ill-equipped to deal" (Zigler, 1966 a, p. 153). Lantz found that a relatively simple failure experience prevented children from profiting by practice which ordinarily leads to improvement on intelligence test scores.

The notion of failure-expectancy is substantiated by Heber (1957) and Gardner, who found that retardates have a low expectancy for success, and, therefore, modify their performance differently from normal children after a success or a failure. On the basis of their studies, it appears likely that a great many retarded children have learned to expect failure and believe that it is seldom worthwhile to increase one's effort, since further failure is likely to ensue.

Other recent studies have shown that the high incidence of failure expected by retardates generates a style of problem-solving characterized

by outer-directedness. Zigler (1966 a, p. 155) describes this to mean that "the child comes to distrust his own solutions to problems and therefore seeks guides to attention in the immediate environment. This outer-directedness may explain the great suggestibility so frequently attributed to the retarded child."

Turnure and Zigler have suggested that the distractability frequently observed in the retarded reflects this outer-directed behavior. This interpretation is in contrast to the frequently held view that distractability is a neurophysiologically determined characteristic of the retarded rather than the reflection of a style of problem-solving resulting from the particular experiential histories of the retardates.

Moss (p. 10) found that while a child whose behavior does not lead to the meeting of standards develops a generalized expectancy that he will be unable to make responses which will result in success, the converse is also true. He found that "a child whose behavior leads to success (the meeting of standards) develops a generalized expectancy that he will be able to continue making responses which will result in success."

These represent the most general characteristics of the mentally retarded which distinguish them from the normal population. On the surface, educable mentally handicapped children do not show evidences of physical, mental, or most other handicaps. Baker (1953, p. 427) exemplifies this as follows: "They do not grope about with extremely poor vision, they do not speak with a speech defect, they seem mentally alert, and generally they are fit specimens of normalcy."

Learning Characteristics of the Educable Mentally Handicapped

Cognitive development is an area of special significance in this study. Smith (1968, p. 14) asserts that "the student interested in

education of the mentally retarded should understand the central concepts related to the development and assessment of cognitive abilities." Although great strides have been made toward an understanding of the cognitive development of the mentally retarded since the time of Itard, a great deal still remains to be done. Hutt and Gibby (p. 394) deplore the fact that "in this area we have barely scratched the surface."

> The interesting relationships between sensory experience and concept formation, between types of overlearning and retention, between discriminate attention and rigidity in learning, and between amounts of anxiety and effects on learning processes need to be explored more adequately, probed more deeply, and evaluated more carefully.

Robinson and Robinson propose that detailed investigations of the learning of retarded children can answer a number of questions which are extremely relevant to planning their educational experiences and to predicting the areas of tasks which they can do well or less well.

One of the most fundamental ways in which retarded children differ from normal children of the same chronological age is in the slowness and inefficiency with which they acquire knowledge and skill. This fact is supported by Kirk (1940, p. 9): "All studies and observations show that the mentally deficient learn more slowly and retain less than normal children. There is no question on this point." Smith (1968, p. 14) affirms: "All populations of the mentally retarded exhibit relative weakness in cognitive development. This is a primary characteristic of these people and exerts an influence on other areas of behavior."

With respect to the cognitive development of the mentally retarded, Johnson (1959) distinguishes between "learning" and "development." He points out that often these concepts have not been differentiated, with the result that articles concerning the development rate of the retarded have appeared where the author has used the term "learning," or the author

has used a reverse of the terms and concepts involved.

When concerned with the rate of development, one may be referring to development in one or more of a number of somewhat discrete and only distantly related areas, such as physical, mental, academic, social. For educational purposes, the mentally retarded group is defined upon the basis of retarded or slow intellectual development. This development is reflected in the theoretical meaning of the intelligence quotient score, which is a ratio showing the relationship between intellectual growth and chronological age. Johnson (1959, p. 69) exemplifies this as follows:

> A child with an IQ of 75 has an intellectual development rate of three-fourths that of the average or normal. A child with an IQ of 66 or 67 is developing intellectually at two-thirds the rate of the average or general population.

Consequently, it takes this individual from one-fourth to one-third times longer to "pass through" a specified developmental growth period than is required for the "average" or normal child.

Hultsch (p. 357) comments that the "rate growth of the educable mentally retarded child is estimated about one-half to three-fourths of the so-called 'average' child."

On the other hand, Johnson (1959, p. 69) indicates that the mentally retarded learn in the same way as normal children. "They are not 'slow learners' in the sense that they comprehend slowly or grasp new concepts slowly or learn a skill slowly. The slowness is related to their rate of intellectual development." Hutt and Gibby (p. 351) agree that "so far as is now known, the general principles of learning which have been developed over the years with normal individuals apply, in most respects, to the retardates as well."

Research demonstrates that mentally retarded children, when matched with normal children of the same chronological age, do poorly at the

beginning but show rapid improvement with continued practice. Cassell reports on a study which was designed to determine the learning ability on various serial learning tasks of normal and mentally retarded children whose mental ages were controlled. He found that it took the retarded longer to adjust to the task. However, once they understood the task, they did as well as normal children. Johnson (1963 b, p. 459) supports this finding: "When they [mentally retarded children] can learn to perform the required task, they follow the same laws of learning and show little or no difference from normal persons of the same intellectual development . . . ."

Wade (p. 182) challenges this view when she describes the Gellner Theory which evolved during eighteen years of study of the brain and of research in the field of mental retardation. She declares that "children become retarded because they are unable to learn in a normal manner in contrast to the accepted idea that they fail to learn because they are retarded."

Just what intelligence is has been the concern of many outstanding psychologists. Many definitions have been offered, varying from intelligence is "what intelligence tests test" to "ability to do abstract thinking" to "problem solving ability" (Serena, p. 5).

Some regard intelligence as a unitary phenomenon; others as a highly specific phenomenon. The unitary concept is best exemplified in the work of Spearman. Some fifty years ago, following extensive research and integration of existing data, Spearman concluded that all intellectual abilities could be expressed as functions of two factors. One is a general or intellectual factor, which is somewhat of a qualitative factor, causing the difference between the intelligent and the retarded person.

This is known as the "G" factor. The other, a specific factor, "S," accounts for the differences in specific achievements of persons. Spearman believes that differences in intelligence from one child to another are essentially functions of the differences in the amount of "G" that is present. According to Spearman's theory, the mentally retarded child has a significantly lesser amount of the "G" factor than normal or superior children.

In direct contrast to this unitary concept of Spearman is that proposed by Thorndike, who maintains that intelligent behavior is the function of highly specific abilities, and that general intelligence is merely the aggregate of these specifics. In this respect, Hutt and Gibby (p. 22) observe that "unlike Spearman, Thorndike does not believe there is such a trait as general intelligence, but, rather, he believes there are a number of specific intelligences" which may be categorized into three groups: abstract, mechanical, and social intelligences. Of the three, abstract intelligence correlates most highly with academic achievement.

In commenting on Thorndike's theory of intelligence, Wechsler agrees that there are many specific intelligences. However, he defines intelligence as functioning basically in two areas: verbal ability and performance ability. He stresses that many determinants other than intellectual ability, per se, are involved in intelligent behavior. Hutt and Gibby (p. 22) believe that these would include "the goal-directed nature of behavior, drive, incentive, and personality variables."

Intelligence tests are designed to measure an individual's ability to perform and to utilize his basic abilities. Children vary tremendously in their degree of intellectual capacity, ranging from extremely inferior to extremely superior levels. In measuring this intellectual capacity by

means of an intelligence test, one finds a large percentage clustering around the middle portion of the range--the average children. A small percentage ranks at an extremely low level, and an equally small percentage ranks at an extremely high level. Tarjan reports that approximately three per cent of the population is assigned an intelligence quotient rating of less than 70.

Educators look to the intelligence test score as a predictor, a measurement, to tell how much, and perhaps the way, the retarded child can learn. Tarjan (p. 429) believes that "intelligence quotients are good predictors of success during the school years."

Among the learning characteristics of the mentally retarded, Ellis (1963 a) indicates that there is good evidence for the presence of a short-term deficit. Such a problem is most noticeable to a teacher when retarded students forget their assignment before they get back to their seat, or forget a new reading word before it appears on the next line.

In terms of long-term memory, on the other hand, there is less evidence of a deficit for retarded children. In fact, there is some evidence that retardates may remember materials well-mastered as well as normal individuals. This leads one to conclude that the problem may not be one of rapid forgetting as suggested by the "leaky bucket theory," but one of difficulty in original learning and in not providing for overlearning (Denny).

In order to provide for the retention of concepts, Smith (1968, p. 63) suggests that "primary emphasis should be put on overlearning, during which time the concept being learned must be put to use in a practical and meaningful way."

Findings reported by Vergason (1964 a) support the contention that

intensive overlearning can compensate fairly adequately for the short memory span of retarded children. In his study, sixty-four retarded subjects and sixty-four normal subjects were trained on a paired-associate task composted of thirteen items. Half of the subjects were trained to a minimum level of performance and the remainder to an overlearning level of performance. The following results were reported:

1. Retarded and normal subjects learned paired-associate tasks at somewhat the same rates

2. Normal subjects were superior to retarded subjects on retention of minimum tasks after one to thirty days

3. Retarded and normal subjects did not differ on retention of the overlearned tasks after thirty days

Vergason (1964 a, p. 629) concludes that "the role of overlearning in acquisition of its subsequent effect on retention in retarded subjects is well demonstrated in this study."

Johnson (1959, p. 69) appears to question the need for overlearning by mentally retarded when he contends: " . . . no more practice time in learning a specific skill or concept . . . should be necessary." However, he admits that additional review is needed to overcome the factor of forgetting.

The theory that mentally retarded children have less difficulty with long-term than with short-term memory supports the postulation of Hebb, a Canadian psychologist whose work has had great influence on present-day psychology. Hebb's theory suggests that "once networks of association are established, their maintenance becomes vital and can be accomplished through the constant use of the information contained within the networks" (Smith, 1968, p. 63).

Benoit (1964, pp. 156-57) describes Hebb's theory as follows:

> Hebb begins with the concept of cell assembly, which he sets forth as the basic mechanism of sensory and motoric response, and the neurological counterpart of psychological experience. He assumes that the impinging of a stimulus on a sense organ activates a chain of cells, distributed mostly in the upper portion of the nervous system . . . . Repetition is viewed as strengthening intercellular bonds, through the enlargement and multiplication of synaptic knobs by some kind of neurobiotaxis.

Hebb's entire theory, according to Robinson and Robinson (p. 310) concerns "the transmission of electrical impulses from one part of the nervous system to another over pathways which become increasingly integrated in the course of experience as they are used over and over in an orderly fashion."

One is led to infer from Hebb's system that by "engaging more cortex; namely, by including the motoric portion of the brain, more opportunity is provided for interfacilitation" (Benoit, 1964, p. 159). Following this assumption, several decades ago, Fernald demonstrated that slow learners pick up speed in learning to recognize words by tracing the letters with the finger or stylus. It may be concluded from these theories of learning that the use of the typewriter would supply appropriate opportunities for stimulating the motoric portion of the brain, thus providing for the necessary interfacilitation. This notion is treated more extensively in the next section of the review of related literature.

In summary, the basic learning characteristics of the mentally retarded are, in all probability, the same as for the normal child of approximately the same mental age. "The exceptional differ from the normal mainly in degree" (Baker, 1953, p. 3). There are differences which may be attributed to controllable factors; however, these are unrelated to "ability" to learn.

Motor Characteristics of the Educable Mentally Handicapped

The objective of this section of the review of related literature is to discuss motor characteristics of the mentally handicapped and their relationship to intelligence. This information has significance with regard to the ability of the mentally handicapped to use the typewriter as a means of improving the learning process.

Studies of the motor characteristics of the mentally handicapped present conflicting views concerning whether or not motor ability is a unitary factor. Motor responses are generally believed to be controlled essentially by kinesthetic (internal) and various kinds of external stimuli, and hence, are not isolated factors. "They are mediated by the neuromusculature, more specifically, synapses, motor herves, and the muscles" (Malpass, 1963, p. 603). Tredgold purports that motor ability of the mentally handicapped is part of the larger picture of general retardation. Sloan (1950) confirms this position when he reports on his experimental study which was conducted in 1950 to measure the relationship between mental retardation and motor ability. He found that motor ability is significantly, but not closely related to the intelligence level of the mentally handicapped. The pupils in his study showed poorer performance than normal children of comparable chronological age. Sloan (1951, p. 405) concludes that "motor proficiency is not a distinct aspect of functioning which can be isolated from general behavior, but is, rather, another aspect of the total functioning of the organism."

Ismail and Gruber (p. 3) acknowledge the inseparable nature of mind and body when they state:

> It is a fact recognized by neurologists that in order for the organism to perceive a complex motor task correctly, all structures in the central nervous system must be fully developed and physiologically "ready" to integrate stimulus and response patterns.

Francis and Rarick's study concerning the motor characteristics of the mentally handicapped gives evidence that motor educability of retardates is organized in much the same way as in children with normal intelligence. This finding suggests that defectives may be able to profit from the same kinds of experiences, including the use of the typewriter, as those provided for normal children.

The Gestalt psychology advances the need to consider the individual as a "whole" within the framework of his environment. Hence, many educators and psychologists consider that motor, as well as intellectual, development is the result of a complex interaction between hereditary, maturational, and environmental factors.[1]

On the other hand, Blackstone and other educators lean toward the Connectionist theory which interprets motor ability in "mechanistic" rather than in "cognitive" terms (Rowe, 1961). Blackstone emphasizes the importance of developing the kinesthetic memory (which he calls the muscular memory) rather than the intellectual memory in teaching typewriting.

Dunn (1963 a, p. 114) concurs with the position of the Connectionists with reference to the motor ability of the mentally handicapped. He advocates the use of an elementary rather than a global approach to the teaching of motor skills such as typewriting to the retarded. "It is unfortunate that educators have reasoned by analogies in applying the Gestalt perceptual phenomenon to the teaching of skill subjects."

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[1] For a recent discussion of the nature-nurture controversy, see Arthur R. Jensen, "How Much Can We Boost IQ and Scholastic Achievement?" Harvard Educational Review, XXXIX (Winter, 1969), 1-123, and responses to this article in Harvard Educational Review, XXXIX (Spring, 1969), 274-347.

Tuttle found that the ability to follow directions has little significance with regard to the ability to learn typewriting. He reports that memory span as shown by the coefficient of correlation in his study has no direct relation to the ability to learn typewriting. Hardaway (p. 372) agrees with this finding when she writes that " . . . IQ's have been shown to have little relation to typing success when judged by speed tests and manipulative process." She adds, however, that "the relationship becomes significant when the measure of achievement involves the ability to arrange and produce usable work."

These conflicting hypotheses concerning the relationship between motor ability and intelligence in the mentally handicapped point to the necessity for educators to be aware of the difference between stimulus response learning (S-R learning) and cognitive learning. Burt (p. 260) has put the problem quite succinctly:

> It is a truism in psychology that the mechanism of the mind stands on a sensory-motor basis. The world outside can stimulate only through one of the senses; and, in return, all that the greatest intellect can do is to contract a set of muscles and move a set of bony levers. The end-product of every mental process is simply a muscular reaction.

Data on motor ability as related to intelligence of the mentally handicapped are not abundant, since the area of motor and psychomotor ability is a relatively new field of inquiry. The results of research dealing with this topic have been reported in depth by Denny. He summarizes studies where the mentally handicapped have been matched with normal pupils according to mental age and where they have been matched according to chronological age. When the mental age control was used, Denny noted that there appeared to be no evidence of a low-IQ deficit in motor learning. Johnson and Blake actually found that the retarded did significantly better than the normal

children on simple motor tasks.

This was not the case, however, when the mentally retarded were matched with other pupils according to chronological age. Two related trends are prominent when retarded and normal children are matched according to chronological age (Denny, p. 129).

1. Mentally handicapped children, excluding the severely mentally handicapped, exhibit a deficit initially, but with practice, improve more rapidly than normal children, and sometimes catch up with them.

2. As the difficulty of the task increases, the importance of intelligence increases, and despite faster improvements, the retarded are unable to make up the differences.

One of the earliest studies with reference to the first point was that of Holman. Using a ball and slot test which emphasized kinesthetic control, she compared the performance of thirteen-year-old normal children with intelligence quotient scores averaging 102 with mentally handicapped children of the same chronological age. At the beginning of the practice, the difference in favor of the normal children was large and significant. By the fourth day, however, the difference was small and nonsignificant, and by the third week there was practically no difference. The retarded children who started as well as the normal children attained a higher final score than did the normal group, and the normal children who started as poorly as the retardates did not reach as high a final score as did the retarded group.

As indirect evidence in support of the same point, Brace evaluated well-practiced athletic skills in mentally retarded girls and found a negligible correlation between motor ability and intelligence.

The literature suggests that when retarded children are provided with a program aimed at developing simple motor skills and given opportunities to practice, they will often be capable of performing at a level

commensurate with their chronological age.

Although recent studies generally show that the mentally handicapped have been found to be somewhat deficient in motor proficiency as well as in intelligence (or perhaps because of their intellectual deficiency), it should be pointed out that they are able to learn, retain, and transfer quite complex motor skills, including typewriting, according to their mental age. Some educators have rationalized that, since the learning abilities of the mentally handicapped are limited, it would not be in the best interest of either the teachers or the pupils to expect them to acquire typewriting skill. Such an attitude is not tenable. Dunn (1963 a, p. 83) stresses that "it may be that pupil attitudes and motivation may be greater detriments to school learning than intellectual incapabilities." Pupils' attitudes often reflect those of their teachers.

An important issue for business education teachers as well as special education teachers is to determine whether or not motor skill in the mentally handicapped can be increased by systematic instruction in typewriting. The results of research dealing with motor educability of the retarded offer conflicting reports.

Alley and Carr (p. 455) hold that "there are no advantages to be derived by educable mentally retarded children from a systematic sensory-motor program . . . ." On the contrary, Denny (p. 136) proposes that "it would be possible to develop appropriate motivational procedures and special training techniques to overcome an appreciable portion of the ratardates' difficulties." Howe (p. 354) contends that, although motor skills are learned incidentally by the typical elementary school child in the regular classroom, it is evident that they must be taught specifically to mentally retarded children. "Perhaps education will need to plan more specific

structured programs for the mentally retarded in the area of motor skills."

Silvey (1955), who designed a course of study for a class of typewriting for the mentally handicapped, remarked that the contribution which typewriting instruction can make to the growth of muscular coordination may be the most valuable aspect of special training in typewriting.

In summary, a review of the literature concerned with the relationship between motor ability and intelligence of the mentally handicapped reveals that the retarded are generally found to be deficient in motor ability. This deficiency results, not from a lack of motor educability, per se, but from retardation in cognitive development. Pertinent writings which treat of typewriting for the educable mentally handicapped indicate that intelligence itself has little direct relationship to typewriting success.

Special Teaching Methods, Including Typewriting, For the Mentally Handicapped

Of particular relevance to the present investigation are the results of research concerned with special teaching procedures for the mentally handicapped, since "conventional procedures . . . do not seem to have been particularly effective in teaching retarded children" (Malpass, et al., p. 2). In a survey of 128 fifteen- and sixteen-year-old educable mentally retarded subjects, Malpass, et al. found that, although they had been in school for at least seven years and in special classes for at least three years prior to the study, 74 of them read below the third grade level and 97, below the fourth grade level. Only one sixteen-year-old approached the seventh grade level. This suggests that educable retarded children profit minimally from conventional classroom procedures.

Johnson and Myklebust (p. 54) reaffirm the need for special pedagogical procedures for the mentally retarded:

> With greater cognizance of the nature and magnitude of the problem of learning disabilities, there is a growing awareness that specialized methods for educational remediation must be developed if these children are to have maximum opportunity for self-actualization.

In his comprehensive review of the literature related to learning experiences for the mentally handicapped, Denny suggests that development of appropriate motivational procedures and special training techniques to overcome an appreciable portion of the retardates' difficulties. Among the techniques suggested by Denny (p. 136) is that of "motivating the retarded child sufficiently and building in what they failed to learn incidentally during the early years, as for example, with specially designed and programmed teaching machines."

Piaget, born in 1896 in Neuchatel, Switzerland, has devoted his life to evolving and elaborating a set of constructs which have provided amazing insights into the development of the functions and structures of the human mind. His theory maintains that we learn by doing, especially during the early developmental period. According to Robinson and Robinson, Piaget believes that the best teaching methods would encourage the pupil to interact concretely as much as possible with the material to be mastered.

Flavell (p. 152) interprets Piaget's theory to suggest that the best way to teach a child some general principle or rule is to begin with action. " . . . The child should first work with the principle in the most concrete and action-oriented context possible; he should be allowed to manipulate objects himself and 'see' the principle of his own actions."

Kolstoe observes that Piaget's system is in agreement with that of Dewey, who, as early as 1896 emphasized the necessity of the learner taking an active part in the educational process. This led many of his followers

to develop methods of instruction which allow the pupil to "learn by doing."

Montessori's activities would lead one to believe that she must have embraced the same philosophical precept as Dewey when she developed her auto-education techniques to train each sense separately. The effectiveness and efficiency of the Montessori system cannot be denied.

Garton (p. 200) recognized the "think and do" principle in formulating her curriculum for the mentally retarded. This is illustrated as follows:

> The mentally retarded child will learn more readily from audio-visual and sensory materials than he will from lectures or explanations. These children are not "word or thought" oriented. They are geared to handle an object, to see it, hear it, to taste it, to smell it, in order to know and understand anything about it.

Researchers have found that typewriting unites the processes of thinking and doing, which results in an improvement in the learning process. Kitson notes in this regard:

> Experimental education has demonstrated that the more efficient learning is the union of thinking and doing; that is, knowledge secured as a result of doing or in connection with doing (p. 326).
> . . . . . .
> Typewriting lends itself readily to the application of this principle. . . . Typewriting affords an opportunity to deal with objects and materials, a natural tendency in most individuals. Typewriting unites thinking and doing . . . (pp. 317-18).

Tonne, Popham, and Freeman have also advocated the "thinking and doing" concept as it pertains to the utilization of typewriting instruction as an aid to other learning.

Moore developed the "talking typewriter" and established a program of typewriting for the mentally handicapped based on the "response environment technique." Among the forty or fifty schools in the United States and England using the $40,000 computer-based system is the St. Louis State School and Hospital, St. Louis, Missouri. For instruction in typewriting

the child goes to a special soundproof booth containing a Language Master tape recorder and an electric typewriter. There is a small screen to the right in the booth on which slides are flashed.

A computer attached outside the booth is programmed for whatever is to be taught. The teacher's voice, on pre-recorded tape, gives instructions and praise for correct work.

The typewriter keys, sometimes covered, sometimes not, will not depress until the proper key is touched. When the child hesitates, the taped voice automatically gives him clues. A new picture and a new instruction is provided after the proper key is activated.

Although the use of the learning booth promises to contribute to concept formation and incentive behavior in the children, there has not been an extensive study of the effectiveness of this program.

In 1960, an investigation was undertaken to determine the effects of typewriting on the personality and achievement of the educable mentally handicapped through the use of a published curriculum (Karnes, Clarizio, and Zehrbach, 1963). It was hypothesized that the acquisition of skill in typewriting would result in improved academic work, greater visualization skills, and better socioemotional adjustment. Fourteen pairs of subjects, matched with appropriate variables were given two to three years of typewriting instruction, utilizing the Keyboard Town Story curriculum prepared by Gallagher (1961).

Gallagher's curriculum was designed so that the entire keyboard should be taught before there is any formal application to typewriting. According to this method, the keys on the typewriter represent story characters who resemble people like those one would meet in school, at home, or in community situations. The activities of these people when

they are downtown and uptown are associated with the keys on the typewriter. As the pupils learn the story, they learn the keys on the typewriter keyboard.

The pedagogy employed in the Keyboard Town Story curriculum appears to be in opposition to the psychological principle of skill, which stresses active involvement of the body with the skill while it is being learned.

Book (pp. 171-72) points out that experimental research has shown that the best results are obtained through the "kinesthetic sensation aroused by striking the . . . keys," and thus strengthening the associative learning of the key location through thinking of its location, striking the key, and writing words in contextual matter.

In support of this view, Blackstone and Smith (p. 103) suggest that

> A person should be able to strike a key by automatic response . . . rather than by consciously directed movements, and . . . attention should be turned to the responses or movements rather than to the keyboard itself.

Based on associative learning, Gallagher's curriculum (1968, p. 7) requires the transfer of learning from the mental image of "town and the interaction of its characters" to the identification of the keys on the typewriter keyboard. It is commonly believed, however, that the retarded are extremely inept in the transfer of learning. Dunn (1963 a, p. 46) notes that this postulation is supported by the vast majority of studies on the learning characteristics of the mentally handicapped. In this connection, Smith (1968, p. 46) refers to research findings which show a definite tendency of the retarded to transfer negative rather than positive learning. "The retarded remember with much greater facility what they are not supposed to do instead of what they are supposed to do."

On the other hand, Johnson and Blake raise some doubts about these generalizations. They have found that in comparison with older educable

mentally handicapped children and younger normal subjects of equivalent mental ages, intelligence does not appreciably affect transfer of learning skills.

Karnes, Clarizio, and Zehrbach (1963) obtained only limited support for the hypotheses of their study. Only two of the seven measures of academic achievement indicated statistically significant differences in favor of the experimental group. Because the differences in visualization skills between the two groups did not approach significance (p=.05), this research hypothesis was rejected. This study revealed that typewriting seemed to benefit approximately 25 per cent of the subjects and that some students manifested a potential for acquiring typewriting as a usable skill.

Characteristics of the Karnes, Clarizio, and Zehrbach study may be summarized as follows:

1. Only two of the seven tests significantly (p=.05) favored the experimental group: mechanics of language and arithmetic computation. Significance was not achieved in reading, vocabulary, and spelling.

2. Instructional materials designed for typewriting, based on the school curriculum, were not developed.

3. Motor skill development through the use of the typewriter was not measured.

Although the basic pattern of the Karnes, Clarizio, and Zehrbach study was used in the present investigation, the methodology employed, the instructional materials used, the length of the experiment, and the measuring instruments varied from that study.

This investigation was intended to extend the body of knowledge acquired by the Karnes, Clarizio, and Zehrbach study through the use of specially prepared programmed materials for typewriting developed according to the linguistic approach to reading and based on the curriculum in use in the special education program in which the study was conducted.

Typewriting for Normal and Gifted Children at the Elementary School Level

Researchers have round that the typewriter has been an effective educational instrument for elementary school children with average or superior intelligence. In his conclusion section of a review of studies concerned with elementary school typewriting, Yuen (p. 122) states, "There seems to be a consensus of opinion [sic] that the increase in academic achievement and high student interest justifies the inclusion of typewriting as a regular part of the elementary curriculum."

Among the earliest typewriting advertisements was one appearing in 1852 which announced that by using the typographer (a forerunner of the typewriter), children would be able to learn composition, punctuation, and spelling, and it would be the source of much amusement (Bliven, p. 39). This advertisement appeared 16 years before Christopher L. Sholes invented the first practical typewriter.

In 1874, advertising literature described the typewriter as "the best known device for teaching children and others how to spell and punctuate correctly. They become so intensely interested that it is play to them" (Current, p. 68).

Perhaps the most extensive study of the educational value of the typewriter at the elementary school level was that directed jointly in 1929-1931 by Wood and Freeman. Approximately 15,000 elementary school children and 400 teachers from 12 different cities in the United States participated in the study. Wood and Freeman reported that the children who used the typewriters advanced more rapidly in all subject matter areas in elementary school than did children who did not use the typewriters.

Olson and Jaskari studied the effects of typewriting on the

educational achievement of children in grades one through nine. They observed that some children who were handicapped in other subjects because of reading difficulties were able to do well in typewriting. For most pupils, they concluded, achievement in typewriting was commensurate with attainment in other subjects, but for pupils with reading retardation, achievement in typewriting may surpass the attainment in the area of reading. This finding is particularly significant because of its implications for the educable mentally handicapped, who as a group, typically have considerable difficulty in learning to read.

During the summer of 1958, Rowe conducted an experiment in the teaching of typewriting to gifted third and fourth grade children. The experiment was designed to explore three areas:

1. Can children at the third and fourth grade levels learn to type by touch?

2. Can typewriting be used to promote the learning process?

3. Will students' achievement improve in reading comprehension, vocabulary, punctuation, spelling, capitalization, and word sense through the study of typewriting?

In Rowe's study, twenty-four third and fourth grade children were in the experimental group and twenty-four in the control group. These children were selected from the public and parochial elementary schools of Grand Forks, North Dakota, and were matched according to intellectual ability, longhand writing speeds, motor dexterity, and achievement in the various phases of the learning process.

All children in the study were of above-average intellectual ability. In the experimental group, the median intelligence quotient score for third graders was 124 and for fourth graders, 125. For the control group, the median intelligence quotient score was 120 for third graders and 121 for fourth graders.

Students in the experimental group studied typewriting for fifty minutes daily for forty days. Students in the control group pursued their normal activities during the summer vacation period, and did not use the typewriter.

At the end of the eight-week study, the following results were reported:

1. The average typewriting speed was forty-two words per minute on one-minute timed writings. The highest speed attained was eighty words per minute; the lowest speed was twenty-five words per minute.

2. The experimental group increased seven months in vocabulary development.

3. The experimental group increased four months in reading comprehension.

4. Both the experimental and control groups lost four months in spelling.

Rowe (1958) concluded that this experimental project produced conclusive evidence that children with superior intelligence can be taught touch typewriting and can improve their educational achievement through this tool.

Capehart and McNish, who conducted an intensive review of the research concerned with typewriting for elementary age children, found that the studies showed the following:

1. Pupils tended to spell, read, and write better
2. Pupils took greater pride in their work
3. Pupils became responsible and more independent
4. Pupils felt successful and more self-confident
5. Pupils were stimulated to greater creative expression
6. Pupils were able to acquire typewriting skill
7. Pupils' papers were neater and more accurate

The researchers commented, however, that many of the projects were lacking

in scope, both in terms of the number of pupils studied and the duration of the study. Many did not include the proper use of control groups against which results could be compared.

Findings reported by Artuso indicate that children who learn to use the typewriter in fourth, fifth, and sixth grades experience both long-range and short-range benefits from the instruction. Artuso undertook a study of fifty matched pairs of fourth, fifth, and sixth grade children to determine whether the use of the typewriter would motivate learning and result in the children's improvement in the total language arts program, particularly in the quality and length of written reports, in spelling, in the mechanics of English, in reading vocabulary, and in reading comprehension.

Artuso (pp. 176-77) concluded: "Because children enjoy using typewriters, and teachers are convinced that the typewriter serves as a motivator of learning in the language arts, educators are justified in making wide use of typewriters in intermediate grade classrooms."

In 1960, a significant study was reported by Durrell, Erickson, and Moore, who conducted research projects simultaneously at Boston University, Columbia University, and the University of Illinois. Findings of their investigation reveal that fourth and fifth-grade pupils of varying intellectual ability are able to learn to type and benefit from it.

Their investigation showed the following:

1. Typewriting has a favorable effect upon general academic achievement.

2. Children in grades four and five using typewriters show greater improvement in various word skills than do pupils not using typewriters.

3. Typewriting stimulates preparation of longer, more comprehensive reports.

4. Teachers and parents regard the typewriter as a valuable educational tool and approve its use in elementary schools.

5. Typewriting stimulates creativity.

6. Typewriting instruction is recommended because it:

    a) improves work habits

    b) reinforces skill in English mechanics

    c) improves composition skills

    d) improves speed and quality of handwriting

Psychological evidence demonstrates that educable mentally handicapped children, whose cognitive and motor abilities seem to develop in the same manner as those of normal children, should benefit as much, if not more, than the normal population through the use of the typewriter as a tool of learning.

Chapter Summary

This chapter has reviewed the related literature in six areas: The first section treated the historical development of education for the mentally handicapped. Present-day interest in the education of the mentally handicapped evolved only after a dark period of centuries during which the retarded were rejected by society, ridiculed, and imprisoned. The first systematic attempt to educate the mentally handicapped began when Itard sought to educate Victor, the Wild Boy of Aveyron in the nineteenth century. Itard's influence has extended to current theories and practices concerning the education of the mentally handicapped. Recent trends reflect a gradual shift from the physiological orientation to a more psychosocial emphasis.

The second section reviewed general characteristics of the educable mentally handicapped. Reports of research concurred that although most educable mentally handicapped children are normal or within the normal range in most areas of their development, their primary deviation is in the area of intellectual growth, where development is below the average range of the general population. Aside from this deviation and the impact it has in terms of intellectual development and high expectancy of failure, educable retarded children appear, react, and grow in essentially the same way and at approximately the same rate as their normal associates.

Generalized learning characteristics of the educable mentally retarded were discussed in the third section. Studies have shown that the retarded follow the same laws of learning and show little or no difference from normal persons of the same intellectual developmental level. Essentially, the mentally retarded differ from the normal population in the following ways:

1. Retarded children learn more slowly and inefficiently than normal children
2. Retarded children have less capacity for understanding abstractions and generalizations
3. Retarded children must be provided with ample overlearning if long-term retention is to be achieved

A review of the literature concerned with motor characteristics of the educable mentally retarded was presented in the fourth section of this chapter. Recent studies seem to be consistent in reporting that the psychomotor development of the mentally retarded is significantly below that found in the normal population. This results not from a lack of motor educability, but rather from retardation in cognitive development. Hence, when retarded children are provided with programs aimed at developing

simple motor skills and given opportunities to practice, they are often capable of performing at a level commensurate with their mental age.

The fifth section of this chapter treated special teaching methods, including typewriting, for the educable mentally handicapped which have been developed to enhance their learning ability. A basic philosophy in education for the mentally handicapped is centered on Dewey's concept that learning occurs most effectively when children are enabled to "think and do" at the same time. Researchers have found that typewriting unites the processes of thinking and doing.

Accordingly, Moore developed the "talking typewriter," and established a program of typewriting for the mentally handicapped based on the "response environment technique." Employing the Keyboard Town Story curriculum, Karnes, Clarizio, and Zehrbach (1963) conducted a study of typewriting for the mentally retarded.

The final section of this chapter reported studies related to typewriting for normal and gifted elementary school children. Although numerous studies have demonstrated that the typewriter can be used effectively in enhancing the learning process of these children, there has been little formal study of typewriting for the educable mentally handicapped--those who comprise approximately three to four per cent of the school-age population.

CHAPTER III

PROCEDURES

Development of the Problem

Based on psychological principles of learning, the assumption was made that the typewriter could be used as a tool of learning to enhance the academic achievement and motor development of the educable mentally handicapped. To investigate this problem, the following procedures and methods, which are classified in ten sections, were used: (1) Development of the Problem, (2) Schools, (3) Population, (4) Sample, (5) Teachers, (6) Materials, (7) Equipment, (8) Orientation Workshop, (9) Method, and (10) Measuring Instruments. The hypotheses which were tested in this experimental study will be presented together with the statistical findings in Chapter IV.

Intensive library research was conducted in order to

1. Review related writings and research
2. Develop an understanding of the characteristics of the educable mentally handicapped
3. Determine effective pedagogical procedures for the education of the mentally handicapped
4. Develop appropriate instructional materials

The following facilities were utilized to secure information and materials for this study: The Chester Fritz Library, University of North Dakota; Fontbonne College Library, St. Louis, Missouri; Washington University Library, St. Louis, Missouri; the professional library of the Director

of Special Education, University of North Dakota; interlibrary loan facilities and the University of North Dakota microfilms, ERIC Clearinghouse on Exceptional Children; and the Special Education Instructional Materials Center, University of Kansas.

Among the indexes and sources reviewed for relevant writings were the following: Business Education Index; Education Index; Reader's Guide to Periodical Literature; Spring and Fall issues of the National Business Education Quarterly; Typewriting Research Index; Shorthand-Secretarial Research Index; Mental Retardation Abstracts; Psychological Abstracts; Bibliography of World Literature on Mental Retardation and Supplement; Fifth Mental Measurements Yearbook; Sixth Mental Measurements Yearbook; and selected bibliographies compiled by Dr. Eleanor B. Brown, Kent State University; Wayne L. Sengstock, National Association for Retarded Children; and Jack P. Nix, State Department of Education, Atlanta, Georgia.

A sample of the five by eight cards used to classify the related literature is presented in Appendix B, page 140.

A preliminary proposal was presented to the Research Seminar in Business Education on February 19, 1969. Participants in the seminar were the writer's major advisor, other faculty members of the University of North Dakota Business Education Department, and doctoral students. In accordance with suggestions made by the members of the seminar, the proposal was revised and re-presented to the seminar on March 13, 1969. The revised proposal was subsequently submitted to the writer's Faculty Advisory Committee on March 20, 1969, at which time it was approved.

The writer contacted the Regional Director of the Bureau of Education for the Handicapped, Division of Research, United States Office of Education, Kansas City, Missouri, requesting an appointment to discuss the

possibility of federal funding for the research. Due to the scope of the study, the Regional Director advised the writer to submit this request to the chief of the Research and Projects Branch, Bureau of Education for the Handicapped, United States Office of Education, Washington, D.C.

Accordingly, a copy of the preliminary proposal was sent to Washington, D.C. for review. In a telephone conversation with the chief of the Research and Projects Branch, the writer was told that the proposal had "reasonable potential" for funding and was encouraged to submit a formal proposal with a request for federal support to conduct the study.

The revised proposal was sent to the Division of Research, Bureau of Education for the Handicapped, United States Office of Education, Department of Health, Education, and Welfare, on March 27, 1969, together with an application for support of the research. In conformity with application procedures, thirty copies of the proposal and twenty additional copies of the abstract were submitted to Washington, D.C. for review and evaluation.

On June 16, 1969, the writer was informed by the Bureau of Education for the Handicapped that the proposal had been evaluated and was found appropriate for support. Authorization to proceed with the work effective August 1, 1969, pending execution of the grant document, was received on September 16, 1969. On October 8, 1969, the Notification of Grant Award was received, informing the researcher that $30,478, the total federal share requested for the research, was being awarded in accordance with P.L. 88-164, Title III, as amended.

The terms and conditions of the research grant required quarterly Progress Reports to be sent to the Bureau of Education for the Handicapped. These reports, submitted on October 31, 1969, January 31, 1970, April 30, 1970, and July 31, 1970, contained an accurate account of the major research

activities and accomplishments of each quarter, the problems encountered, any major departures from the original research plan, significant preliminary findings, informational materials released, capital equipment acquisitions, progress in data collection, staff utilization, and a description of planned activities for the next reporting period. Copies of newspaper or magazine articles describing project operations were listed and accompanied the Progress Reports. Appendix C, page 142, contains the outline for Progress Reports, and a sample of the cover and title page. Fifteen copies of the dissertation were submitted to the Bureau of Education for the Handicapped as a final report of the project.

Schools

Five alternative schools were available for conducting this study. They were as follows:

1. Special Education Program of the Archdiocese of St. Louis, Missouri, with noninstitutionalized mentally handicapped pupils who attend special education classes in parochial elementary schools.

2. St. Mary's Special School, St. Louis, Missouri, with institutionalized and noninstitutionalized pupils who attend this institution.

3. St. Coletta School for Exceptional Children, Jefferson, Wisconsin, with institutionalized pupils who attend this institution.

4. Teacher education program for special education teachers at St. Louis University, St. Louis, Missouri, with noninstitutionalized pupils who are in the practicum of St. Louis University teacher education classes.

5. Special education classes in Grand Forks, North Dakota, with noninstitutionalized pupils who attend these classes.

After discussing the alternatives with the writer's major advisor and with Monsignor Elmer H. Behrmann, Director of the Special Education Program in the Archdiocese of St. Louis, Missouri, it was decided that the

first alternative would provide optimum conditions for conducting the research.

On December 30, 1968, Monsignor Elmer H. Behrmann consented to have the experimental study conducted in five special education classes in the Special Education Program of the Archdiocese of St. Louis, Missouri. In June, 1969, it was found necessary to expand the number of participating classes to nine in order to obtain a sufficient number of subjects for the study. See Appendix D, page 146, for a list of the participating schools and for a copy of the letter of approval from Monsignor Behrmann.

Population

The subjects of this study were chosen from a population of approximately 300 noninstitutionalized mentally handicapped children who constitute the total enrollment in the Special Education Program of the Archdiocese of St. Louis, Missouri.

A preliminary meeting with the participating teachers was held at Fontbonne College, St. Louis, Missouri, in August, 1969, for the purpose of establishing a frame from which the sample for the study was taken. Each teacher completed a data sheet which described the characteristics of the pupils in her class. See Appendix E, page 149.

In order to identify reasonably homogeneous groups for this study, all educable mentally handicapped pupils in the frame between the chronological ages of eight and fifteen were screened. Subjects for the study were confined within the educable limits as defined by the American Association on Mental Deficiency; that is, those with intelligence quotient scores ranging from fifty-five to eighty-four. (The educable limits for the State of Missouri are forty-eight to seventy-eight.) Those who had observable

indications of sensory-motor impairment (paralysis, deformities, history of seizures), as well as other special clinical types, were not included in this study. This restriction was deemed necessary since, in this study of the influence of typewriting on the academic and motor development of the educable mentally handicapped, subjects needed to possess the physical abilities that tend to insure proper stroking techniques in typewriting.

Sample

In June, 1969, the initial sample consisting of sixty educable mentally handicapped pupils was chosen from the population; thirty were randomly assigned to the experimental group and thirty to the control group. At that time, it did not seem feasible to obtain a sufficient number of matched pairs within the chosen population because of the mobility of the subjects. However, in September, 1969, it was found that among those students who remained in the classes twenty-four pairs of educable mentally handicapped pupils could be identified. These pupils were matched on the basis of mental age.

Four subjects were eliminated from the study: three because of transferral from the special education program, and one because of excessive absences. A total of fifty-six subjects completed the experimental study: twenty-eight in the experimental group, and twenty-eight in the control group. Within this group, twenty-two matched pairs completed the study.

Variables relevant to this investigation were analyzed for covariance. Applying the multiple regression formula to the following variables of the subjects in the experimental and control groups, it was found that

the F-ratio for each of the variables was nonsignificant at the .01 level: chronological age, mental age, intelligence quotient score, and educational achievement level. (See Table 2 below) There was less chance than one in 100 that there would be a significant difference between the variables in

TABLE 2

SUMMARY TABLES OF CHARACTERISTICS OF SUBJECTS AT THE BEGINNING OF THE STUDY

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F Value	.01
		Chronological Age			
Among Groups	1.82478	4	.45617	1.91	NS
Within Groups	12.17532	51	.23873		
Total	14.00000	55			
		Mental Age			
Among Groups	1.51889	3	.50630	2.11	NS
Within Groups	12.48111	52	.24002		
Total	14.00000	55			
		Intelligence Quotient			
Among Groups	1.36347	2	.68174	2.86	NS
Within Groups	12.63653	53	.23843		
Total	14.00000	55			
		Educational Achievement Level			
Among Groups	.69712	1	.69712	2.83	NS
Within Groups	13.30288	54	.24635		
Total	14.00000	55			

each group. This allowed for an exploration of the effects of the use of the typewriter on the learning process and on the motor development of the educable mentally handicapped.

A summary of the characteristics of the subjects who participated in this study is presented in Table 3 below. See Appendix F, page 151, for a list of the characteristics of the individual subjects in this investigation.

TABLE 3

SUMMARY OF CHARACTERISTICS OF SUBJECTS AT THE BEGINNING OF THE STUDY

Variable	Experimental Group	Control Group
Number	28	28
Number of Boys	14	22
Number of Girls	14	6
Mean Chronological Age in Years	12.8	12.3
Mean Mental Age in Years	9.1	8.4
Mean Intelligence Quotient Score	71	70
Mean Grade Equivalent	3.0	2.8
Mean Socioeconomic Status	67	66

To determine the influence of typewriting on those matched pairs of subjects who are classified as "borderline retarded," according to the definition of the American Association on Mental Deficiency (See Table 1, page 18), compared with pupils who are classified as "mildly retarded," the matched pairs were divided into two groups. Group A consisted of those pupils whose intelligence quotient score ranged between -1.01 and -2.00

standard deviation units from the mean (IQ 68 to 83); Group B consisted of those pupils whose intelligence quotient score ranged between -2.01 and -3.00 standard deviation units from the mean (IQ 52 to 67). See Appendix F, page 151, for the characteristics of the matched pairs in Groups A and B at the beginning of the study.

Teachers

For maximum efficiency in conducting this study, it was determined that regular qualified special education teachers should teach the typewriting classes. Educable mentally handicapped children have differences in learning patterns from normal children. These are well-understood by their teachers who have had professional preparation and experience in teaching the mentally handicapped. Equipped with the knowledge of the special needs of each child in her class, the regular special education teacher would be in an advantageous position to obtain optimum results from the instruction.

Therefore, with the approval of Monsignor Elmer H. Behrmann, Director of the Special Education Program of the Archdiocese of St. Louis, Missouri, nine qualified teachers of the mentally handicapped were requested to conduct the experimental and control classes. All nine teachers had gained a reputation for professional competence and concern for the welfare of the children.

The researcher outlined and explained the program in detail to the teachers. (See "Orientation Workshop," page 61) A discussion followed and questions were answered. The teachers all agreed to cooperate in the study.

Table 4, page 56, exhibits the academic and professional qualifications of the participating teachers. The average teaching experience of

TABLE 4

QUALIFICATIONS OF PARTICIPATING TEACHERS ACCORDING TO TEACHING EXPERIENCE AND ACADEMIC DEGREES

Teacher	Years' Teaching Experience			Academic Degrees			
				Bachelor		Master	
	Special Educ.	Other	Total	Major	Minor	Major	Minor
1	20	10	30	Education	Speech	Education	Special Education
2	10	12	22	Education	Philosophy	Special Education	Psychology
3	12	22	34	History	English	None	None
4	20	15	35	Education	English	Education	Psychology
5	12	30	42	Education	English	None	None
6	10	15	25	Education	English	Special Education	Psychology
7	19	7	26	Education	Psychology	None	None
8	5	11	16	Education	Speech Pathology	Special Education	None
9	5	10	15	Education	History	Special Education (Cand.)	None

the teachers was twenty-seven years, ranging from fifteen to forty-two years; the average teaching experience in special education was thirteen years, ranging from five to twenty years. The academic preparation of the teachers included three master's degrees in special education, one candidate for a master's degree in special education, and two master's degrees in education with special education and psychology minors. Eight of the

nine participating teachers had bachelor's degrees in education.

Materials

A search of the literature yielded no appropriate materials for typewriting for the educable mentally handicapped. Consequently, the construction of special programmed materials based on the linguistic approach was undertaken for this study.

In preparing the instructional materials for typewriting for the educable mentally handicapped, two areas were considered:

1. Instructional materials prepared were to follow accepted methodology for teaching typewriting. Philosophical and psychological application to the teaching of typewriting were adapted to the needs of the educable mentally handicapped.

2. Instructional materials were to be based on a reading series currently in use in the Special Education Program of the Archdiocese of St. Louis, Missouri. They were to be programmed materials, linguistically oriented, and designed for the educational achievement level of the pupils.

The investigator was assisted in the development of the typewriting materials, instructions, and progress records, by a qualified reading and special education specialist, and by a typewriting specialist. These specialists came to Grand Forks, North Dakota, from St. Louis, Missouri, to collaborate with the investigator during the summer of 1969 in the construction of the materials. They worked in Grand Forks, North Dakota, in order to be in close proximity with Dr. John L. Rowe, author of many typewriting textbooks, who agreed to serve as a consultant for the study.

The reading and special education specialist is a teacher of the mentally handicapped in St. Louis, Missouri, who has a master's degree in education with a minor in special education from St. Louis University, St. Louis, Missouri. The typewriting specialist is a college business

teacher in Kansas City, Missouri, who has a master's degree in Business Education from The Catholic University of America, Washington, D. C.

Five volumes of programmed materials were developed for the study. These are described as follows:

Volume I, entitled Typing Fun, was designed to teach the pupils a modified system of touch typewriting. This book was adapted from an unpublished textbook manuscript of instructional material for elementary typewriting designed for low-ability students. The writer's major advisor obtained permission from the Gregg Division of McGraw-Hill Book Company to use the experimental edition of Basic Gregg Typewriting, Book 1, for adaptation for this study. Typing Fun contains forty lessons for preliminary typewriting; each lesson is one page in length and has a large lettered keyboard chart printed at the top of each page. Brown (1965 a, p. 277), who has researched the area of typewriting for the handicapped, suggests: "For the mentally handicapped, it is usually advisable for the teacher to have a large keyboard chart on the wall for the student to observe throughout the learning period. A lettered keyboard may also be desirable."

The researcher believed that a lettered keyboard on each individual page of material would provide the subject with greater confidence during the preliminary typewriting phase of the study. Subjects could quickly glance at the individual keyboard chart to obtain locational security in typewriting. The risk of distraction and loss of place, which may occur if the chart would be located elsewhere, was minimized.

Volumes II, III, IV, and V, entitled Book 1, Book 2, Book 3, and Book 5, were designed to supplement the Houghton-Mifflin reading series, which was currently in use in some of the special education classes in

the Archdiocese of St. Louis, Missouri. The typewriting materials corresponded with the educational achievement level in reading of the participating pupils. Materials were not prepared for the fourth grade because of an insufficient sample of subjects at that level. The special education classes which were not using the Houghton-Mifflin reading series, agreed to obtain this material for the purpose of this study.

The advantages and disadvantages of using the Houghton-Mifflin reading series in preference to another reading series currently in use in some of the special education classes were given careful consideration. In consultation with the participating teachers, it was decided that the Houghton-Mifflin series was particularly well-designed as a basal series for this study. It contains exercises in the basic skills required for reading, including the use of structural and phonetic analysis and the use of context clues. Hence, the series provided an appropriate foundation for linguistically oriented typewriting materials for the educable mentally handicapped.

Each of the four volumes contained 200 pages of programmed typewriting materials. One hundred two-part lessons were included in each volume: Part A of each lesson was a review of current vocabulary words which were to be typed on the page; Part B of each lesson included a variety of programmed exercises which provided for reinforcement of the language arts skills.

The researcher was assisted by two typists during the summer of 1969 in producing 840 offset paper masters containing the materials which were used for this study. The Stenographic Bureau of the University of North Dakota printed the materials, which were then sent to St. Louis, Missouri. In August, 1969, the typewriting materials were assembled,

bound in tablet form, and distributed to the participating classes.

Covers for the volumes were made of heavier colored paper which was printed in St. Louis, Missouri, with a design and the title of the book. Each volume was identified by the color of its cover: Typing Fun, blue; Book 1, orange; Book 2, pink; Book 3, yellow; and Book 5, green. See Appendix G, page 158, for samples of these materials.

Complete instructions and progress records were included with the instructional materials. The directions were written in informal language so that any qualified teacher of the mentally handicapped could familiarize herself with the objectives and the pedagogy involved in each lesson. She would not need to have formal training in typewriting methodology in order to give the pupils adequate instruction in the use of the typewriter.

The teachers submitted two formal progress records, which included reports on pupils' response to the materials, the teachers' reaction to the materials, and adjustments which were found necessary in the materials. These reports were discussed at the conferences which were held on October 23, 1969, approximately six weeks after the beginning of the study, and on December 21, 1969, about the mid-point of the study. See Appendix H, page 163, for a sample of the progress record form.

Equipment

Forty Royal 550 and Royal 660 electric typewriters with pica type were rented from the Royal Typewriter Company, St. Louis, Missouri. Royal typewriters were selected because the mechanical design of the typewriter was appropriate for this study, and because of the interest in the project manifested by the educational division of the company. Pica type

was specified for the typewriters because it was believed that the larger print would be easier for educable mentally handicapped children to read than elite type.

One typewriter was provided for each pupil in the experimental group, one for each teacher, and one extra typewriter in reserve in the event of a mechanical failure of any of the typewriters. Each classroom had either all Royal 550 or Royal 660 electric typewriters; the two models were not mixed in any classroom.

Individual nonadjustable typewriting tables were purchased for the pupils from an office equipment company in St. Louis, Missouri. Although it was originally considered advisable to obtain adjustable typewriting tables and chairs for the subjects in the experimental group, this aspect was reconsidered in accordance with the recommendations of the participating teachers. They advised that individual, nonadjustable typewriting tables and chairs would be more practical for the pupils.

Orientation Workshop

Prior to the initiation of the experimental program of typewriting for the educable mentally handicapped, an Orientation Workshop was conducted for the participating teachers by the researcher and the specialists who collaborated in the preparation of the materials. The workshop was held on September 3, 1969, at St. Anthony School, St. Louis, Missouri, from 9:30 a.m. to 3:00 p.m.

The purpose of the Orientation Workshop was to present an overview of the experimental study, to acquaint the teachers with the operation of the electric typewriters and with the specially prepared programmed materials, and to explain thoroughly the procedures and testing program.

Furthermore, an opportunity was provided to answer questions concerning the program, and to establish a good working relationship among the participants in the research.

The agenda for the workshop included the following:

1. A demonstration on the use and care of the electric typewriters, given by the district sales representative of the Royal Typewriting Company.
2. A presentation of the testing program, given by the psychometrist for the study.
3. An explanation of the programmed materials and an opportunity to become acquainted with the procedures to be followed in the study.
4. Distribution of the Metropolitan Achievement Tests, Form A.

Typewriters were provided for each of the participating teachers and for the workshop coordinators. Following the general session, the teachers were separated into three groups. Under the direction of the workshop coordinators, the teachers familiarized themselves with the operation of the electric typewriters and with the procedures to be followed in the use of the programmed typewriting materials.

Method

The purpose of this study was to determine the influence of typewriting on language arts skill and motor development of the educable mentally handicapped. In order to measure the difference in achievement between the experimental and control groups resulting from the use of the typewriter, the Pretest-Posttest Control Group Design (Van Dalen) was used in this study. This is an experimental design which involves a control group as well as an experimental group. Psychologists developed the Pretest-Posttest Control Group Design during the first quarter of the twentieth century when they were endeavoring to overcome the difficulties

of confounded extraneous variables in the one-group experimental design. The addition of a second group is an attempt to control those factors which may invalidate the results.

Good (p. 455) classifies the Pretest-Posttest Control Group Design in the category of "True Experimental Designs," and notes its advantage as follows: "This experimental design seeks to control the main effects of history, maturation, testing, instrument decay, regression, selection, and mortality."

Thirty subjects in the experimental group and thirty in the control group were divided into sub-groups according to their educational achievement level as determined by their reading ability. With regard to sub-groups, Smith (1968, p. 266) indicates that

> One of the most time-honored means for individualizing instruction has been to separate a class into smaller units which within themselves are relatively homogeneous in one or more characteristics. Level of achievement has been the criterion most often used for selecting groups.

Table 5, page 64, lists the sub-groups according to educational achievement level in each of the classes. It can be observed from this table that there were no more than three sub-groups in each class. Six of the nine classes had two sub-groups; one had one sub-group. Concerning the number of groups wich can be taught most effectively in each class, Smith (1968, p. 267) holds: "Instructional groups in classes for the retarded should not exceed two or three. Teaching will be less efficient when more than three groups are used in a subject area."

This experimental study was conducted in two phases: phase one was the period of the first eight weeks, during which pupils were taught a modified system of touch typewriting; phase two was the following twenty weeks during which the subjects participated in the language arts typewriting program.

TABLE 5

SUB-GROUPS IN EACH CLASS ACCORDING TO GRADE LEVEL

Class	Level I		Level II		Level III		Level V		Total Sub-Groups
	E*	C	E	C	E	C	E	C	
1	x	x			x	x	x	x	3
2			x	x		x			2
3			x	x	x	x			2
4			x	x	x	x			2
5					x	x			1
6			x	x		x	x		3
7	x	x	x	x					2
8			x				x		2
9	x	x						x	2

*Experimental and control groups

In order to provide the pupils in the experimental group with the skill necessary to use the typewriters, the subjects in the experimental group were taught a modified system of touch typewriting during the first phase of the study; that is, for eight weeks prior to the experimental language arts program. Typewriting instruction was given by the regular special education teacher who taught typewriting for a period of forty-five minutes each day at varying intervals, depending on the receptivity of the pupils. The subjects in the experimental group received approximately thirty hours of typewriting instruction during the fall semester, 1969. Instruction was given forty-five minutes daily, Monday through

Friday, for eight weeks, from September 22, 1969 through November 14, 1969.

During the period when the experimental group received preliminary instruction in typewriting, pupils were taught as one group in each of the nine classes. They learned to type the alphabetic keys, the punctuation marks, and the use of the essential service mechanisms. The same amount of language arts instruction was provided for both the experimental and control groups in order to equalize their progression.

Materials used to teach the pupils a modified system of touch typewriting are described in Section 6, page 57, of this chapter, "Materials." Basically, the teaching procedure was the same for the educable mentally handicapped as for normal children. Differences occurred, however, in keeping with the intellectual ability of the pupils.

In order to assist the pupils in the use of the correct fingers for typewriting, the typewriter keys were color-coded with strips of colored mystic tape attached to the sides of the keys. The colors served as reminders for correct finger control of the keys. Some of the subjects colored the keys on their individual keyboard charts in Typing Fun with appropriate colors as they learned each new key. Initially, pupils wore colored plastic rings on their fingers with colors corresponding to the color-coded keys. However, it was discovered that this procedure was inconvenient for typewriting, and the rings were discarded after the first few lessons.

At the completion of the first phase of the study, preliminary typewriting, the second phase, language arts typewriting, began on November 17, 1969. Specially prepared programmed materials designed to supplement the Houghton-Mifflin reading series for grade levels 1, 2, 3, and 5, were used by the experimental and control groups. Subjects in the experimental group

used the typewriter to complete the programmed exercises designed to improve language arts skills; subjects in the control group completed the exercises in the traditional manner; that is, by writing or printing with pencil or pen. Subjects in both groups were encouraged to vocalize the words as they typed or wrote to further reinforce the concepts. One teacher provided the subjects with earphones to minimize distractions as the words were being vocalized.

Although the standard course of study in the language arts program was presented to both the experimental and control group, both groups had an opportunity to cover additional materials if and when the occasion arose. During the 45-minute instructional period, the pupils in the experimental group, and in limited instances, those in the control group, were able to cover materials in addition to those provided for in this study. Supplementary work included letters, compositions, lists of spelling words, and sentences using the spelling words.

Each group received instruction for a period of 45 minutes daily in addition to their regular reading period. The 45-minute period was interspersed with intervals of rest and relaxation at the discretion of the individual teacher. Classes were conducted every day, Monday through Friday, for twenty weeks, from November 17, 1969 through April 17, 1970. Each group received a total of 100 lessons; approximately 75 hours of instruction.

A series of conferences was held during the study by the researcher and the teachers who conducted the classes. These conferences were held at Fontbonne College, St. Louis, Missouri, on the following dates: October 23, 1969, November 26, 1969, December 21, 1969, January 31, 1970, and March 17, 1970.

During the conferences, the teachers discussed their experiences

and their progress records; they offered suggestions and asked pertinent questions. These conferences provided a means for systematic communication between the researcher and the participating teachers.

The researcher observed each class in which the study was being conducted approximately three or four times from October, 1969, through March, 1970, on the following dates: October 24, 1969, November 26, 1969, January 30, 1970, and March 18, 1970. These observations served as a means of monitoring the proceedings and of ascertaining if there were any individual difficulties in the classes participating in the program. Informal one-minute timed typewriting tests were administered in each of the classes for the purpose of motivation and periodic progress check.

The following specialists in typewriting and in special education served as consultants for this study:

> Monsignor Elmer H. Behrmann, Ph.D., Director of the Special Education Program, Archdiocese of St. Louis, Missouri
>
> Dr. Steven D. Harlow, Director, Special Education Program, University of North Dakota, Grand Forks, North Dakota
>
> Dr. John W. Kidd, Assistant Superintendent, Department for the Mentally Retarded, Special School District of St. Louis County, Missouri
>
> Dr. John L. Rowe, Chairman, Department of Business Education, University of North Dakota, Grand Forks, North Dakota

See Appendix I, page 167, for biographical sketches of these consultants.

On January 30, 1970, the consultants observed the classes in which the study was being conducted. On January 31, 1970, they participated in an all-day conference with the teachers involved in the study at Fontbonne College, St. Louis, Missouri. During the morning session of the conference, each consultant delivered a presentation of approximately one-half hour, during which he gave his reaction to the typewriting program, his observations in the participating classes, and his recommendations.

The presentation of the consultants was followed by a report of the psychometrist for the study. This report consisted of an historical review of the Lincoln-Oseretsky Motor Development Scale, including a description of the test, and observations concerning pupil performance on the pretest.

The morning session was tape-recorded in order that the proceedings could be reproduced for the benefit of the participants and others interested in the study.

In the afternoon, a general session was held, during which the program was discussed informally by the consultants and the participating teachers.

On March 17, 1970, Dr. Steven D. Harlow, consultant for the study, participated in a conference with the researcher and the cooperating teachers at Fontbonne College, St. Louis, Missouri. The purpose of the conference was to evaluate the progress of the program, to discuss changes, including attitudinal changes, which had occurred as a result of the program, to answer questions concerning the study, and to offer suggestions with regard to the pedagogy being employed. The evaluations are summarized in Chapter IV, Findings. See Appendix J, page 171, for a sample of the Evaluation Form. At the conclusion of the meeting, the Metropolitan Achievement Test, Form B, which was to be administered as a posttest, was distributed to the teachers.

In order to obtain additional information concerning the subjects participating in this study, each teacher was requested to write a case study of the subjects in the experimental and control groups. The case study included the following items: family history, educational experiences, social-personal characteristics, level of accomplishment, changes

which have occurred as a result of the program, and other additional information which would be of interest regarding the subjects. A sample of the form used for the case studies is presented in Appendix K, page 173. Selected case studies are presented in Appendix Q, page 221, and discussed in Chapter IV, Findings.

In order to determine parental reaction to the program, parents were requested to submit an appraisal of the experiment. To provide maximum freedom for their responses, an open form of questionnaire was designed and sent to the parents by the individual teachers. Van Dalen (p. 303) maintains: "Rather than forcing respondents to choose between rigidly limited responses, the open-form questionnaire permits them to answer freely and fully in their own words and their own frame of reference." Parental responses are presented in Appendix S, page 234, and discussed in Chapter IV, Findings.

On March 18, 1970, Dr. Harlow and the researcher observed four classes participating in the study. These were the classes which Dr. Harlow had been unable to visit because of the time limitation on January 30, 1970. An average of approximately 45 minutes was spent in each class, during which the activities of the experimental and control groups were observed. The researcher and the consultant had an opportunity to discuss the program with the individual teacher in the setting of the study.

Certificates of achievement, displayed in Appendix L, page 175, were awarded to the subjects in the experimental and control groups at the completion of the study. These certificates were signed by the researcher, by her major advisor (the project director), and by the individual teacher.

Measuring Instruments

The following tests were chosen to measure the selected language arts skills, the motor development, and the modified touch typewriting skill of the pupils: Metropolitan Achievement Test, Forms A and B, one of the most commonly used standardized achievement tests used to measure the individual's educational achievement level (Johnson, 1967 a); the Lincoln-Oseretsky Motor Development Scale, the most widely used standardized battery of tests of motor skill (Benton); and an adaptation of a standardized straight-copy typewriting test published by the United Business Education Association. An adaptation of a test published by the United Business Education Association, rather than one published by the Psychological Testing Corporation, as originally proposed, was used in accordance with the recommendation of the researcher's major advisor. He believed that the former would be more appropriate to measure the modified touch typewriting skill of the educable mentally handicapped. See Appendix M, page 178, for a sample of the final straight-copy typewriting test.

The Metropolitan Achievement Test was used to measure the following language arts skills: reading, word knowledge, and spelling for subjects in grade levels two, three, and five; reading and word knowledge for subjects in grade level one. The Lincoln-Oseretsky Motor Development Scale was employed to assess motor performance in the following areas which require fine motor movements:

1. Touching nose
2. Touching fingertips with right hand
3. Touching fingertips with left hand
4. Finger movement

5. Closing and opening the hands alternately
6. Making dots
7. Tapping with the right hand
8. Tapping with the left hand
9. Drawing lines with the right hand
10. Drawing lines with the left hand
11. Cutting a circle with the right hand
12. Cutting a circle with the left hand
13. Tracing mazes with the right hand
14. Tracing mazes with the left hand

The Wechsler Intelligence Scale for Children (WISC) was administered individually by the psychometrist for the study to all pupils who had not received an individually administered intelligence test within the past two years.

Following the recommendation of the writer's major advisor, an appointment was arranged in February, 1969, with Mr. Arnold E. Bakke and Dr. Florence Patterson, guidance counselors at a local high school in Grand Forks, North Dakota, for the purpose of reviewing and evaluating the selection of tests for this study. The counselors concurred that appropriate measuring instruments had been chosen for this study.

Findley (p. 67), who reviewed the Metropolitan Achievement Test in The Sixth Mental Measurements Yearbook, recommends the instrument as "a superior test series representative of the high quality and usability of modern achievement tests, with as fine an interpretive manual as is to be found."

In her review of the Lincoln-Oseretsky Motor Development Scale, in The Fifth Mental Measurements Yearbook, Espenshade (p. 834) lauds its

value with these words: "The scale in its present form should provide a valuable tool for the study of certain aspects of motor development of children, especially those between six and twelve years of age. No comparable scale exists at the present time."

Oseretsky developed a motor ability scale in Russia which took Binet as its paradigm, giving a motor age analagous to a mental age. In 1948, Sloan devised the Lincoln adaptation of the Oseretsky test, which was used in this study. The purpose of his revision was to make the items more usable with American subjects and to make the administration and scoring conform more closely to test practices prevailing in this country. All of Oseretsky's original subtests were retained in this revision (Rabin).

The Lincoln-Oseretsky Motor Development Scale was administered individually to all pupils by a qualified psychometrist in September, 1969 (pretest), before the first phase of the program, preliminary instruction in typewriting. The test was administered at that time so that any motor development which possibly resulted from the preliminary instruction in typewriting would not contaminate the results of the experiment. The administration time for the Lincoln-Oseretsky Motor Development Scale was approximately forty-five to sixty minutes each for the pre- and posttest.

Appropriate subtests of the Metropolitan Achievement Test, Form A, were administered in November, 1969 (pretest) by the regular special education teacher for each class after the completion of the first phase of the study, preliminary typewriting instruction. The test was administered at this time to preclude the influence of the preliminary typewriting instruction on the selected language arts skill development. The adminis-

tration time for the Metropolitan Achievement Test was approximately seventy minutes each for the pre- and posttest.

The Metropolitan Achievement Test, Form B, the Lincoln-Oseretsky Motor Development Scale, and the straight copy typewriting test were administered at the conclusion of the experiment, during the week of April 20, 1970 (posttest).

The socioeconomic status of the subjects was considered only for the purpose of adequate representation of pupils in the experiment. The socioeconomic status of the subjects in this study, listed in Table 6 below was determined by the ranking of the Prestige Occupational Scale (Hodges, Siegel, and Rossi). This scale was designed by the National Opinion Research Center in 1947 and revised in 1963. It allows a prestige

TABLE 6

SOCIOECONOMIC STATUS OF SUBJECTS

Range of Socioeconomic Rank Based on Prestige Occupational Scale	Number of Subjects			Percentage of Subjects
	E*	C	Total	
1 to 14	1	1	2	3
15 to 29	1	0	1	2
30 to 44	0	2	2	3
45 to 59	4	7	11	19
60 to 74	14	10	24	41
75 to 90	9	10	19	32
Total	29	30	59	100

*Experimental and control group

score or rating to be assigned to each child's parental occupation. The actual range of rankings available are from ninety for "Shoe Shiner" to one for "U. S. Supreme Court Justice." It can be observed that almost three-fourths of the subjects (73 per cent) are in the lower third of the socioeconomic scale with no significant difference between the experimental and control groups. The lower socioeconomic ranking of this sample was verified by the participating teachers. The value of a scale such as the Prestige Occupational Scale in determining socioeconomic status is attested by Hodges, Siegel, and Rossi (p. 322): "The prestige hierarchy is perhaps the best studied aspect of the stratification systems of modern society." See Appendix N, page 182, for a copy of the Prestige Occupational Scale.

After pretesting, all profiles were deposited with the investigator and only those required for purposes of adequately representing pupils were used. At the conclusion of the posttests, all profiles were submitted to the investigator for data analysis. At no time during the study were the test data available for anyone other than the personnel with major responsibilities in this research. These precautions were taken to protect the anonymity of the pupils.

Although the central problem of this study was the influence of typewriting on language arts skill and motor development, the collection and analysis of data concerning acquisition of a modified touch typewriting skill was considered. Therefore, the rate at which the subjects could type at intermediate intervals during the study was tested. The procedure for the administration of the timed typewriting tests was as follows: Two one-minute straight-copy typewriting tests were administered by the regular special education teacher. The material was designed by the researcher,

based on vocabulary familiar to the pupils. The first timed typewriting test was administered at the completion of the first phase of the study: after eight weeks of preliminary typewriting; the second was administered at the completion of fourteen weeks of typewriting, when one-half of the program was completed. Detailed directions regarding the administration of the typewriting tests accompanied the timed writings. Each subject in the experimental group was instructed to type the material as rapidly and accurately as possible for one minute. The same procedure and the same material was used for a second and a third minute. The highest score was recorded. A copy of the intermediate typewriting tests is presented in Appendix O, page 185.

Statistical Analysis of the Data.--The effects of the experiment were measured by the adjusted mean difference of pupils' achievement in reading, vocabulary, spelling, and motor development as determined by the selected tests. The pupils' modified touch typewriting ability was measured by an adaptation of a straight-copy typewriting test published by the United Business Education Association. The differences between the performance of the experimental and control groups found on the pre- and posttests were analyzed for significance by the use of analysis of covariance, using the adjusted posttest score as the criterion.

Analysis of covariance was used since this method provides for an adjustment of the means for the effect of the uncontrollable variables (such as academic ability) and makes the necessary modifications in sampling errors. The corrected sampling error is subsequently used to test for the significance of difference among adjusted means (Downie and Heath).

Chapter Summary

The problem of this study was to determine the influence of type-

writing on academic achievement and motor development of the educable mentally handicapped. To realize the objective of this study, the Pretest-Posttest Control Group Design was utilized.

The sample consisted of 60 educable mentally handicapped pupils from the population of approximately 300 noninstitutionalized mentally handicapped children who attended the special education classes in the Special Education Program of the Archdiocese of St. Louis, Missouri.

Special programmed typewriting materials based on the language arts curriculum were developed for this study. Subjects in the experimental group were taught a modified touch typewriting skill on standard electric typewriters prior to the experimental language arts typewriting program. This was accomplished through the regular special education teacher. After acquiring a modified touch typewriting skill (which required 30 hours of instruction), the experimental group received 100 forty-five-minute lessons in selected language arts skills during the period of both preliminary typewriting instruction and language arts instruction (through typewriting). They used the same materials as those in the experimental group, but completed the exercises in the traditional manner; that is, by using pencil or pen.

The 28-week experimental study was conducted during the fall and spring semesters, 1969-1970. During this time, the researcher observed the classes and held conferences with the participating teachers in St. Louis, Missouri. Specialists in the field of typewriting and special education served as consultants for the study, and participated in the conferences with the teachers.

Measuring instruments used in this study were the Metropolitan Achievement Test, the Lincoln-Oseretsky Motor Development Scale, and an

adaptation of a typewriting test published by the United Business Education Association. The data dervied from the measurement of pupils' performance on pretests and posttests were treated statistically to determine the significance of change.

CHAPTER IV

FINDINGS

The problem of this study was to determine the influence of typewriting on selected language arts skills and motor development of the educable mentally handicapped. Specifically, an investigation was made of the academic achievement of the educable mentally handicapped in reading, vocabulary, spelling, and motor skill development resulting from the use of the typewriter and specially prepared programmed typewriting materials.

The purpose of this chapter is to report and to analyze the findings of this study with respect to the significance of measurable and statistically immeasurable change resulting from the treatment. The findings are presented in the following order: (1) Statistical Analysis of the Data; (2) Attitudes Toward Typewriting for the Educable Mentally Handicapped; (3) Progress Records; (4) Publicity, and (5) Chapter Summary.

Statistical Analysis of the Data

Findings of the statistical analysis of the data are presented as they relate to the hypotheses tested.

> First Hypothesis.--There will be a significant difference in the adjusted means in posttest scores for reading between the experimental group and the control group as measured by the Reading subtest of the Metropolitan Achievement Test, using the pretest as a covariant.

Table 7, page 79, contains a summary table of the analysis of

TABLE 7

SUMMARY TABLE OF ANALYSIS OF COVARIANCE FOR READING

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value
Among Groups	86.90	1	86.90	1.52
Within Groups	3027.28	53	57.11	
Total	3114.18	54		

covariance of the adjusted mean scores for reading. It can be observed that the adjusted mean difference between the experimental and control group yielded an F value of 1.52. This is not statistically significant at the .05 level.

Table 8, page 80, contains a summary of actual mean scores, adjusted mean scores, and change in grade equivalents which resulted from treatment. The experimental group gained 5.1 months in reading during the seven month study; the control group, 3.7 months. There was a difference of 1.4 months (27 per cent) in favor of the experimental group. The range of grade equivalents for reading ranged from -7 months to 27 months (2 years, 3 months) for the experimental group; -7 months to 31 months (2 years, 7 months) for the control group.

On the basis of the nonsignificance of the F value yielded by the analysis of covariance, the first hypothesis cannot be accepted.

See Appendix P, page 188, for the language arts raw scores and grade equivalents for the individual subjects in the experimental and control groups.

TABLE 8

SUMMARY OF MEANS OF RAW SCORES AND CHANGES IN GRADE EQUIVALENTS

Item	Experimental Group	Control Group	Difference
Reading:			
Actual pretest means	22.31	19.75	2.56
Actual posttest means	29.99	25.36	4.63
Adjusted means	28.95	26.40	2.55
Change in grade equivalents in months	5.1	3.7	1.4
Range of grade equivalents in months	-7 to 27	-7 to 31	
Vocabulary:			
Actual pretest means	22.71	22.39	.32
Actual posttest means	26.75	26.86	-.11*
Adjusted means	26.62	26.98	-.36
Change in grade equivalents in months	2.8	3.4	-.6
Range of grade equivalents in months	-4 to 16	-5 to 12	
Spelling:			
Actual pretest means	21.33	20.95	.37
Actual posttest means	26.24	24.62	1.62
Adjusted means	26.07	24.78	1.29
Change in grade equivalents in months	4.8	3.7	1.1
Range of grade equivalents in months	-4 to 38	-16 to 25	

TABLE 8--Continued

Item	Experimental Group	Control Group	Difference
Composite Motor Development Scores:			
Actual pretest means	18.11	15.50	2.61
Actual posttest means	23.39	19.11	4.28
Adjusted means	22.65	19.84	2.81

*Minus figures in the difference column are in favor of the control group.

The raw scores and grade equivalents in language arts for the matched pairs in Groups A and B are presented in Appendix P, page 188. A t test of the means of the raw scores in reading revealed a t value of .078 for Group A, with 20 degrees of freedom and 1.436 for Group B with 20 degrees of freedom. Neither of these ratios were statistically significant.

Second Hypothesis.--There will be a significant difference in the adjusted means in posttest scores for vocabulary development between the experimental group and the control group as measured by the Word Knowledge subtest of the Metropolitan Achievement Test, using the pretest as a covariant.

The second hypothesis was tested by the analysis of covariance which resulted in an F ratio of .103, which is nonsignificant at the .05 level. (See Table 9, page 82)

Table 8, page 80, reveals that the difference in the adjusted means of the raw scores for vocabulary was .36 in favor of the control group.

TABLE 9

SUMMARY TABLE OF ANALYSIS OF COVARIANCE FOR VOCABULARY

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value
Among Groups	1.81	1	1.81	.103
Within Groups	930.26	53	17.55	
Total	932.07	54		

Changes in grade equivalents were 2.8 months for the experimental group, ranging from -4 to 16 months (1 year, 2 months); 3.4 months for the control group, ranging from -5 to 12 months. There was a difference of .6 month in favor of the control group..

Since the F ratio for vocabulary was nonsignificant at the .05 level, the second hypothesis was rejected.

The change in vocabulary scores of the matched pairs as a result of treatment was analyzed by means of the t test. This test yielded a t value of .54 for Group A, and a t value of .67 for Group B. Neither of these values reached the designated level of statistical significance.

Third Hypothesis.--There will be a significant difference in the adjusted means in posttest scores for spelling between the experimental group and the control group as measured by the Spelling subtest of the Metropolitan Achievement Test, using the pretest as a covariant.

Since subjects at the first grade level did not receive instruction in spelling, spelling tests were administered only to those on the second, third, and fifth grade levels. Twenty-one subjects were tested for spelling in the experimental group, twenty-one in the control group.

Table 10, below, reveals that the F value derived by means of the analysis of covariance for spelling was .79, which is not statistically significant at the .05 level. Since this analysis suggests that the observed difference in the adjusted means of the experimental and control groups were not significant, the third hypothesis is not considered tenable.

Table 8, page 80, indicates that the average gain in grade equivalent for the experimental group was 4.8 months, ranging from -4 to 38 months (3 years, 2 months); the average gain for the control group was 3.7 months, ranging from -16 months to 25 months (2 years, 1 month). The experimental group exceeded the control group by a gain of 1.1 months (23 per cent) in grade equivalent for vocabulary.

A t test of the raw scores in spelling for the matched pairs in Group A was .63; in Group B, -.261. Neither of these t values were significant at the designated level of confidence. (See Appendix P, page 188)

Fourth Hypothesis.--There will be a significant difference in the adjusted means in posttest scores for motor development between the experimental and control groups as determined by selected subtests of the Lincoln-Oseretsky Motor Development Scale, using the pretest as a covariant.

Table 11, page 85, presents a summary of the analysis of covariance

TABLE 10

SUMMARY TABLE OF ANALYSIS OF COVARIANCE FOR SPELLING

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value
Among Groups	17.65	1	17.65	.791
Within Groups	869.98	39	22.31	
Total	887.63	40		

for the fourteen subtests and the composite score of the subtests of the Lincoln-Oseretsky Motor Development Scale which were selected to measure motor development as a result of treatment.

Since zero scores were not considered in the analysis of covariance, the numbers reported for each test change in accordance with the number of zero scores obtained on the tests.

Table 11, page 85, shows that two of the subtests yielded significant F ratio's: Motor Test Number 2, Touching Fingertips with the Right Hand, and Motor Test Number 7, Tapping with the Left Hand. Motor Test Number 2 had an F value of 8.94, which is highly significant; Motor Test Number 7 has an F value of 4.85, which is significant at the .05 level.

Motor Test Number 4, Finger Movement, lacked a few points for significance at the .05 level. The value of F was 4.71, whereas 4.75 was needed for significance.

Although statistical significance was found in only two of the motor subtests, the data revealed that the adjusted means of the experimental group exceeded those of the control group in ten (71 per cent) of the fourteen subtests.

On tests which measured the motor ability of the right and left hand alternately, it was found that the F ratio for the left hand was higher than the F for the right hand on the following three sets of subtests: Tests Number 7 and 8, Tapping, with an F of 4.85 (significant) for the left hand, and an F of .334 for the right hand; Tests Number 11 and 12, Cutting Circles, with an F of 1.615 for the left hand, and an F of .193 for the right hand; and Tests Number 13 and 14, Tracing Mazes, with an F of 2.35 for the left hand, and an F of .244 for the right hand.

The measured performance of the right hand exceeded that of the

left hand, as revealed by the F ratio for the following two sets of subtests: Tests Number 2 and 3, Touching Fingertips, with an F of 8.94 (highly significant) for the right hand, an F of .84 for the left hand; and Tests Number 10 and 11, Drawing Lines, with an F of .658 for the right hand, and an F of 0 for the left hand.

Raw scores for the individual subjects in the experimental and control groups for the motor subtests and for the composite score of the motor subtests are presented in Appendix P, page 188.

Since only two of the subtests of motor ability were statistically significant, the fourth hypothesis received only partial support from the data.

TABLE 11

SUMMARY TABLES OF ANALYSIS OF COVARIANCE FOR THE SUBTESTS AND THE COMPOSITE SCORE OF SUBTESTS FOR MOTOR DEVELOPMENT

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Adjusted Means E[a]	Adjusted Means C	Adjusted Mean Difference	F
			Motor Test Number 1--Touching Nose				
Among Groups	.0008	1	.0008	2.91	2.92	-.01	.007
Within Groups	5.6517	46	.1229				
Total	5.6525						
			Motor Test Number 2--Touching Fingertips with Right Hand				
Among Groups	2.04	1	2.04	2.91	2.47	.44	8.94[b]
Within Groups	10.27	45	.23				
Total	12.31	46					

TABLE 11--Continued

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Adjusted Means E[a]	Adjusted Means C	Adjusted Mean Difference	F
Motor Test Number 3--Touching Fingertips with Left Hand							
Among Groups	.18	1	.18	2.78	2.65	.13	.84
Within Groups	9.72	46	.21				
Total	9.90	47					
Motor Test Number 4--Finger Movement							
Among Groups	.26	1	.26	3.00	2.67	.33	4.71
Within Groups	.66	12	.06				
Total	.92	13					
Motor Test Number 5--Closing and Opening the Hands Alternately							
Among Groups	.07	1	.07	2.81	2.71	.10	.21
Within Groups	8.62	26	.33				
Total	8.69	27					
Motor Test Number 6--Making Dots							
Among Groups	.008	1	.008	2.92	2.88	.04	.08
Within Groups	1.790	13	.099				
Total	1.798	14					
Motor Test Number 7--Tapping with the Right Hand							
Among Groups	.19	1	.19	2.23	2.44	-.21	.334
Within Groups	10.00	17	.59				
Total	10.19	18					

TABLE 11--Continued

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Adjusted Means E[a]	Adjusted Means C	Adjusted Mean Difference	F
Motor Test Number 8--Tapping with the Left Hand							
Among Groups	2.63	1	2.63	2.44	1.72	.72	4.85[c]
Within Groups	11.40	21	.54				
Total	14.03	22					
Motor Test Number 9--Drawing Lines with the Right Hand							
Among Groups	.057	1	.057	1.05	1.14	-.09	.658
Within Groups	2.466	28	.088				
Total	2.523	29					
Motor Test Number 10--Drawing Lines with the Left Hand							
Among Groups	.0	1	.0	1.25	1.25	.0	0
Within Groups	2.25	9	.25				
Total	2.25	10					
Motor Test Number 11--Cutting a Circle with the Right Hand							
Among Groups	.18	1	.18	2.41	2.23	.18	.193
Within Groups	16.37	18	.90				
Total	16.55	19					
Motor Test Number 12--Cutting a Circle with the Left Hand							
Among Groups	.35	1	.35	1.86	2.33	-.37	1.615
Within Groups	1.52	7	.22				
Total	1.87	8					

TABLE 11--Continued

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	Adjusted Means E[a]	Adjusted Means C	Adjusted Mean Difference	F
Motor Test Number 13--Tracing Mazes with the Right Hand							
Among Groups	.098	1	.098	1.55	1.40	.15	.244
Within Groups	5.617	14	.401				
Total	5.715	15					
Motor Test Number 14--Tracing Mazes with the Left Hand							
Among Groups	.90	1	.90	1.75	1.40	.35	2.53
Within Groups	10.02	28	.36				
Total	10.92	29					
Composite Motor Scores of the Subtests							
Among Groups	105.20	1	105.20	22.65	19.84	2.81	3.73
Within Groups	1492.83	53	28.17				
Total	1598.03	54					

[a]Experimental and control groups

[b]Statistically significant at the .005 level

[c]Statistically significant at the .05 level

Fifth Hypothesis.--The educable mentally handicapped can acquire a modified touch typewriting skill as determined by an adaptation of a straight-copy typewriting test published by the United Business Education Association.

The decision to accept or reject the fifth hypothesis was based on the one-minute straight-copy typewriting rate of the educable mentally handicapped subjects. Table 12, page 89, lists the individual typewriting rates for three one-minute straight-copy typewriting tests which were

TABLE 12

STRAIGHT COPY TYPEWRITING RATE
(Words per Minute)

Subject	First Test	Second Test	Third Test	Subject	First Test	Second Test	Third Test
1	12	13	22	15	18	20	23
2	17	25	30	16	14	14	24
3	7	14	16	17	7	18	24
4	11	14	32	18	17	12	18
5	14	15	24	19	8	15	34
6	16	24	30	20	9	21	17
7	7	9	24	21	12	16	25
8	9	13	20	22	11	19	24
9	17	15	32	23	17	24	24
10	14	16	20	24	11	21	30
11	10	14	21	25	7	15	32
12	15	22	22	26	8	12	10
13	9	15	19	27	14	12	12
14	7	14	23	28	6	10	12

administered during the investigation. The first test was administered after eight weeks of preliminary typewriting; the second, at the completion of fourteen weeks of typewriting (the mid-point of the study); the third, at the completion of the typewriting program.

The average straight-copy typewriting rate for the third test was twenty-three words per minute, with a range of ten to thirty-four words per minute, and a standard deviation of 6.33. The average straight-copy typewriting rate of normal high school students at the end of one semester (usually, sixteen weeks) is twenty to thirty words per minute. Seventy-five per cent (twenty-one) of the subjects in this study typed twenty words or more per minute on a one-minute straight-copy typewriting test; 25 per cent (seven) typed at least thirty words per minute. Hence, the fifth hypothesis was accepted. On the basis of this finding, it is tenable that educable mentally handicapped pupils can acquire a modified touch typewriting skill.

Since subjects in the experimental group achieved a modified touch typewriting skill, instructed by their regular special education teacher, it appears that special education teachers can teach typewriting to the educable mentally handicapped without highly specialized preparation in typewriting methodology.

For additional information, subjects in the control group were tested for their handwriting rate of speed by using the same materials employed for the final straight-copy typewriting test. The handwriting rates of the individuals in the control group are listed in Table 13, page 91. The average rate of speed for handwriting was sixteen words per minute, with a range of five to thirty-two words per minute. The mean typewriting rate, twenty-three words per minute, exceeded the mean

TABLE 13

HANDWRITING RATE OF SPEED FOR
SUBJECTS IN CONTROL GROUP
(Words per Minute)

Subject	Rate	Subject	Rate
1	32	15	16
2	24	16	16
3	24	17	16
4	24	18	16
5	24	19	14
6	22	20	14
7	21	21	13
8	20	22	11
9	19	23	11
10	19	24	11
11	19	25	11
12	18	26	8
13	17	27	8
14	17	28	5

Mean handwriting rate--16 words per minute

handwriting was sixteen words per minute, with a range of five to thirty-two words per minute. The mean typewriting rate, twenty-three words per minute, exceeded the mean handwriting rate, sixteen words per minute, by 30 per cent (seven words per minute).

Attitudes Toward Typewriting for the Educable Mentally Handicapped

In this study of the influence of typewriting on academic achievement and motor development of the educable mentally handicapped, many intangible and statistically immeasurable findings were reported by teachers and parents. It was found that pupils, whose lives had been characterized by academic, personal, and social failure, achieved success in acquiring modified touch typewriting skill. This resulted in an enhancement of self-confidence which influenced their conduct and academic achievement.

The findings in this section are offered not as refined attitudinal measurement, but rather as introductory evidence which could enrich the study. They are presented in the following categories: (1) Attitudes of Pupils in the Experimental Group; (2) Attitudes of Pupils in the Control Group; (3) Attitudes of Pupils Who Did Not Participate in the Study; (4) Attitudes of Parents; (5) Attitudes of Teachers; and (6) Other Reactions.

Attitudes toward the typewriting program and the programmed materials used in this study were gleaned from the following sources: pertinent questions on progress records; case studies; pupils' letters; parents' letters; teachers' evaluations; and discussions at conferences. Section 3, page 104, "Progress Records," presents additional findings from the progress records. See Appendix Q, page 221, for selected case studies; Appendix R, page 230, for unedited samples of pupils' letters; Appendix S, page 234, for unedited excerpts from parents' letters; and Appendix T, page 238, for a summary of the teachers' evaluations.

Attitudes of Pupils in the Experimental Group.--In answer to the question on the progress record: "How did the pupils in the experimental group respond to the typewriting materials?", the following illustrative

comments were made. In general, they indicated a favorable reaction to the materials.

"They like them very much."

"They are very anxious to do the exercises and to not seem to tire."

"Generally, they are enthusiastic and do their assignment without complaint."

"They want to anticipate free days or holidays by doing extra pages."

"They experienced no trouble with the materials, except in some cases where the directions were geared more to the teacher than to the pupils."

One teacher remarked that if the children were absent from school, they would ask their parents to get their typewriting exercises for them. Her comment was: "Would that they were that careful of other work."

On the December progress record, submitted at the December 21, 1969 conference held at Fontbonne College, St. Louis, Missouri, one teacher stated that her pupils found the materials "rather long and drawn out."

Responses to the query on the progress record: "How did the pupils in the experimental group respond to typewriting?" also showed a favorable reaction. Representative comments follow:

"They are very enthusiastic and seem to be doing well."

"They love it and are very concerned if there is a change in the daily schedule that the typewriting period is not overlooked."

"They are eager to use the typewriter and want to demonstrate their ability to all visitors."

"They do not seem to tire of typewriting, and would type for several hours if permitted to do so."

School records revealed that almost three-fourths of the subjects (73 per cent) were in the lower third of the socioeconomic scale, according to the Prestige Occupational Scale. The case studies revealed that some of the children came from broken homes, had little parental encouragement, suffered cultural deprivation, and often experienced failure. Their achievement in typewriting provided some of the pupils with their first experience of success and achievement. Excerpts from the case studies portray the pupils' attitudes toward the typewriting program.

> Case Study Number 1.--One child was extremely anxious, worried for fear that he would make a mistake in school. There was a history of daily vomiting caused by fear of not being able to produce what was expected. He had been absent from school frequently. This ceased when he learned to type. His teacher reported that he missed only one day of school during the current school year.
>
> Case Study Number 2.--A 14-year-old boy who was reported to be emotionally immature, insecure, and impulsive had been in the special education class for six years. His listening skills were poor, his speech careless, and his academic performance fluctuated. Typewriting was especially advantageous to this boy for it gave him a sense of accomplishment not previously experienced. As a result, he never failed to complete his daily lessons and delighted in doing other assignments on the typewriter.
>
> Case Study Number 3.--A 12-year-old boy completed a reader for the first time in his school career, and felt that he had done so with real success. He was able to do this because the vast amount of drill on vocabulary provided him with an understanding of the words, and he was able to concentrate on the content of the stories. This resulted in a vast increase in reading comprehension. His whole attitude changed toward reading, and he now enjoys this skill.
>
> Case Study Number 4.--A tall 14-year-old boy with an IQ of 56 was hyperactive and found concentration difficult. He lacked self-confidence and had a negative attitude about himself and the world around him. He had met failure often, even at play. Although he was tall, nice-looking, well-built, and always neat and clean, he had no real friends. By his constant and repetitive questions, he annoyed other children. He was often tantalized by them, but did not fight back; rather, he resorted to name-calling.
>
> His attitude toward school had been very negative. However, since his success in typewriting, this changed greatly. He enjoys

typewriting, having achieved a fairly accurate thirty-two words per minute. He was found telling others frequently of his achievement, whereas formerly he told only of the things he could not do.

This pupil's self-confidence manifested itself in many ways: in walking to school alone, although formerly he feared to walk the four blocks, in spite of the fact that his parents and teachers repeatedly assured him that it was not hazardous; in attempting to cut his own meat; in knocking at the door of the teacher next door each morning to greet her, whereas before typewriting, he would not go next door to deliver a written message; and in adjusting the venetian blinds in the classroom.

Case Study Number 5.--One of the pupil's greatest difficulty was poor auditory and visual perception. He seemed unable to synthesize letter sounds and visual symbols. Through the repetitive typewriting exercises, he improved significantly in written and oral language. Before typewriting, he had been unable to compose complete sentences. Through the use of the typewriter, he achieved this ability. He used every available minute for typing his study words and captions at the top of his drawings.

Case Study Number 6.--An immature 12-year-old girl with an IQ of sixty-six, who had evidenced a lack of self-confidence, took great pride in the fact that she could type. As a result of typewriting, her attention level increased, her reading, spelling, and writing improved markedly, and her other responses reflected the newly experienced sense of achievement. Given the opportunity to do additional typewriting when her regular school work was completed, she used every available minute for this activity. She labeled all her pictures by typing the names of the objects on them. She also typed labels for other children's pictures, thus becoming the subject of their admiration. One of her classmates, a Mongoloid girl, was frequently seen standing at her side to watch her type.

Case Study Number 7.--A girl, who was the youngest of five children, was completely dependent upon her mother with whom there appeared to be an extremely interdependent relationship. She lacked self-confidence, and had no social life apart from her mother. She was fearful and even became apprehensive if her father was a few minutes late in calling for her after school.

Her teacher indicated that typewriting had instilled much self-confidence in this girl. She became more sociable with other children, making friends for the first time. Although the interdependent relationship with her mother continued to exist, typewriting provided a diversion from her mother and gave the girl great satisfaction.

Case Study Number 8.--A 15-year-old boy with an IQ of 83 was insecure and often frustrated because of failure. His teacher observed that he did not relate easily to others, and was in need of experiencing success, particularly in academic areas. Typewriting provided him with this accomplishment, which resulted in greater security in reading, spelling, and motor control. His attitude toward other studies also evidenced improvement.

Case Study Number 10.--One teacher noted that a girl in her experimental group seemed to have "new life" as far as school work was concerned. This was attributed to her success in typewriting. The recommendation had been made on her case record that she be given an opportunity for vocational training. Typewriting at a straight-copy rate of approximately twenty-one words per minute with reasonable accuracy provided her with prevocational training.

Case Study Number 11.--The youngest of five children in a home upset by domestic problems, one 11-year-old boy whose attention and concentration skills were poorly developed, whose memory was weak, and whose word attack skills were deficient, displayed a decided change as a result of typewriting. His interest rate mounted, and his work showed notable improvement.

Case Study Number 13.--A pupil who was a twin and the second youngest of nine children in an unstable home had been brought up by her older brothers and sisters, since both parents were employed with two jobs. There was an unhealthy competition between this girl and her twin brother, who was in a regular elementary class. This resulted in the child's negative self-concept and feeling of inferiority.

Since typewriting, however, she recognized that she had accomplished a skill which other children, and particularly her brother, did not possess. This greatly enhanced her sense of personal worth. Her teacher noticed that her written work was neater, apparently due to the pride she had taken in her neat typewriting papers.

Case Study Number 14.--A girl who formerly wrote the letters of the alphabet incorrectly due to poor hand and eye coordination was aided by the typewriter. Seldom after typewriting did she leave unclosed letters or make reversals. Previously, she had been unaware of her errors, but now she recognized them immediately and was eager to correct them.

Case Study Number 15.--A 13-year-old girl who was one of ten children was withdrawn and reticent, relating to others on an immature level. She showed little self-confidence and was apprehensive in a learning situation. This child tended to give up easily, and demonstrated signs of insecurity. She seemed to enjoy typewriting and showed radical improvement in the following areas as a result of typewriting: attitude toward school, self-confidence, sociability.

Case Study Number 17.--A 13-year-old girl was anxious, lonely, nervous, and easily distracted. As a result of typewriting, she greatly improved. At the beginning of the study, she would pout when her mistakes were indicated; however, as the program progressed, she brought her papers to her teacher to find out if she was improving. This child expressed regret that the typewriting program was over, and stated that she would like to continue to type.

Case Study Number 18.--A hyperactive boy of fourteen, who had mild brain damage, fluctuated in his academic performance. Although his typewriting reflected this fluctuation, his teacher noted an improvement in his reading and spelling. This was due, she believed, to the repetition of words, phrases, and sentences in the typewriting exercises.

The following unedited remarks taken from letters written by subjects in the experimental group reveal their reaction to the typewriting program. These comments likewise indicate parental attitudes toward the study.

"I hope we have this program next year, because I like it a lot, and so does everybody else. . . . My mother likes this program a lot. We got a typewriter, it is not an electric one."

"My mother and father like it [typewriter] because they want my reading to do better. . . . My uncle think the typewriting program real neat."

"My mother likes this typing program very much. And my sister Pat likes it too. I like it very much because it is interesting and you learn how to type and, When you know how to type you type real fast."

The psychometrist for this study revealed that when she asked the pupils to be tested, "What do you like best about school?", the invariable answer was, "typewriting."

The following comments made by participating teachers portray the attitude of the pupils in the experimental group to the typewriting program:

> Once a week, children had a free morning to go swimming at the pool provided for them at St. Mary's Special School in St. Louis, Missouri. The children repeatedly asked if they could forego swimming in order to remain in the classroom to type. They even wanted to go to school during the Christmas and Easter holidays, and often requested to prolong the 45-minute period allotted for typewriting.

> One child in an inner city school, who was from a very deprived home, appeared to be following the course of his older brothers. They had discontinued school by the time they were his age (11 years). However, he remained in school this year because of his interest in typewriting.

> A child who was particularly fearful and discouraged by his frequent failures accidentally depressed the return key of the typewriter on the first day of school without realizing the action it would cause. His left hand was in the path of the carriage, which struck it with force and caused a minor injury. Although it was anticipated that he would fear the typewriter as a result of this accident, he soon was back and eager to learn to type.
>
> With a minimum of direction, they [the pupils] are typewriting with enthusiasm. Every morning from 8:45 to 9:30, the pupils take out their folders and begin to type . . . . They love it and ask a dozen times if they can begin to type--even before school starts.
>
> I think you'll be surprised with the work. Truly, I'm surprised they have done so well. I am just so amazed at how fast they learn. My problem is to keep enough work for them to keep busy.

It was not unusual, according to some of the teachers, to hear, "Can't we do just one more page?" Some pupils asked to type their mathematics and other assignments.

Attitude of Pupils in the Control Group.--The attitude of the pupils in the control group to the typewriting activity was sought by means of the following question on the progress record: "How do the pupils in the control group respond to the typewriting activity which is taking place?" Responses showed two types of reaction: some pupils were satisfied with their role; some pupils were dissatisfied because they wanted to learn to typewrite. Comments which exemplify these attitudes follow:

Satisfied.--Progress records contained these reports: "Much to my surprise, it [typewriting] hasn't bothered them." "It does not seem to disturb their activities. They have been promised the use of the typewriters in April, and are satisfied." "They have accepted their role in this study very well, and do not seem to resent being denied the use of the typewriters. They are as conscientious in doing their work as are the typists."

Further remarks concerning the attitude of the pupils in the control group were made by the participating teachers at the conferences:

A 14-year-old girl who has an IQ of seventy-three, with brain damage as a result of an automobile accident at the age of two years, is content in doing her programmed exercises in the control group. So, far, she has not seemed too interested in the typewriting program.

An adopted boy of fourteen was highly motivated by having been chosen to participate in the control group. He had a history of absenteeism, having missed fifty-two days of the previous school year. During the present school year, he has been absent only ten days, and boasts of his good attendance record.

"The children in the control group manifest greater interest in reading than ever before."

The teachers reported that during the final six to eight weeks of the study, some of the subjects in the control group who had been satisfied with their activities were becoming bored with the programmed exercises which they were completing in the traditional manner; that is, with pencil or pen. They evinced an eagerness to have an opportunity to use the typewriters. Although the teachers endeavored to motivate the pupils and to create renewed interest in the work, a noticeable restlessness was evident among the pupils in the control group.

Dissatisfied.--The following remarks were reported on the progress records: "They [control group] need a great deal of motivation, since they cannot use the typewriters." "Although they do their work well, they are anxious to learn to type."

The following comments made by the participating teachers during the conferences, depict the attitude of some of the pupils in the control group:

One boy in the control group resented not being able to type. When one of the pupils in the experimental group transferred from the special education program, this boy asked to take her place. Being denied this request, his interest in the activities of the control group were sustained only by repeated promises that he would be taught to type at the conclusion of the study. It was difficult for this boy to persevere in completing the materials

each day, and he ignored the challenge of covering the answers on the programmed sheets.

"Pupils in the control group repeatedly ask: 'When will we learn to type, too?'"

Attitude of Pupils Who Did Not Participate in the Study.--The participating teachers reported that pupils who were not participants in the program were anxious to learn to type. They asked: "Will we get to learn to type next year?"

One boy who had been late for school almost every day since its opening asked if he could type before school in the mornings. His teacher consented, with the result that the child left home at 7:45 every morning, took two busses, and arrived at school at 8:30 a.m. to type for a half hour before school started. He had not been tardy since given this opportunity to type.

Attitude of Parents.--Parents of the pupils in the experimental group were requested to express their attitude toward the typewriting program. Many of the parents previously had shown little or no interest in the activities of the school, according to reports from the teachers. However, responses were received from the parents of twenty-six pupils in the experimental group. This was the first time some of the parents reacted to a school activity. See Appendix S, page 234, for unedited parental responses.

The general reaction of the parents, as revealed by their comments, was that of enthusiasm for the program. They expressed pleasure that their children had been selected to participate in the typewriting study. Some parents stated that noticeable improvements were observed in their children's conduct and educational achievement.

Observing the favorable effects of the typewriting program on their children, some parents purchased typewriters for their children. The teachers mentioned that the purchases were made only with difficulty by some of the lower-income families.

The following unedited excerpts from the parental responses demonstrate their attitude toward the typewriting program:

> I was very impressed when I heard that some of the children were being taught typing. I am thrilled that Mary Brigid is one of the children learning to type. I feel that this will be very helpful to her not only in motor coordination, but also in improving her attention span. This can also help build up her confidence. . . . Mary Brigid is very interested in typing and talks about it at home a great deal.
>
> There has been a very big improvement in her reading and in all her school work in general in the past month or two. . . .If the typing project is helping the children as it seems to be doing then I think it is very important and should be continued.
>
> I have noticed an improvement in Jack's reading since he's been typing, and seems more interested in reading also, he now gets books out to read without me asking him to.
>
> I personally feel that this is indeed a "break thru" for the class.
>
> We are so thrilled and pleased with the way Helen is learning to type. It has made her concentrate and stay on one subject for awhile. Since typing she reads much better. Before she was always adding or leaving out words. Her vocabulary has also improved and she is making complete sentences. My hopes and prayers are for this program to continue.
>
> Mr. Freund and I have noticed a remarkable change in Linda this term. She seems very interested in the spelling & meaning of words.
>
> Jeanne seems to be the focal point of interest at our home and being chosen . . . to participate in the typing program made us very pleased. We believe it is helping her in many ways.
>
> . . . . . .
>
> Jeanne is a very shy and uncertain person and learning anything that she knows she's accomplishing helps her feel more secure - in this sense typing helps because it's something she can do all by herself. I think it encourages her to read more because she has been trying to read newspapers and magazines and never seemed interested before.

She expresses a definite interest in typing which I feel is important to children who are retarded - I believe the satisfaction they have when they know they're doing a job well is very important to them.

I am happy there is a typing program at Epiphany Special School, and Jeffrey was chosen to participate. I am positive it will help Jeffrey's coordination.

I think this program is a world of good for the children. Craig now asks about what the words are on the TV casts which he didn't pay any attention to before, and also about things in the paper, for example. We were talking about the plane that flew thru the Arch, he wanted to see the printing about the story and wanted to know why he did it. He also looks at the comics now.

Only one parent responded negatively: "I haven't noticed any change in Christy's work."

Parental attitudes were revealed in case studies as indicated by the following:

Case Study Number 1.--One child's parents were very serious, severe, and extremely exacting. They found it difficult to accept their child's retardation. However, during the past year, they seemed to be more relaxed and endeavored to help him in a more positive manner. This was attributed by his teacher to their observation of his success in typewriting.

Parents of some of the children in the control group and of pupils not participating in the study expressed to the teachers their desire that their children be given an opportunity to learn to type.

Attitude of Teachers.--The attitude of the participating teachers toward the typewriting program was revealed by their evaluation which was submitted at the close of the study, by letters, conferences, and private conversations. See Appendix T, page 238, for a summary of teachers' evaluations.

The teachers' responses indicated that they were satisfied with the pupils' achievement in typewriting. They were also proud of their own success in teaching a modified system of touch typewriting to the educable mentally handicapped pupils in the experimental group. Some of the teachers

were nontypists; however, by following the directions given in the typewriting materials, they were able to teach the skill to their pupils. They expressed regret that the program came to an end, and stated that participating in it was "stimulating, challenging, and rewarding."

One teacher commented:

> It would be great to have typewriters and materials for the entire group or class because it has definitely taken some of the "labor" out of teaching the subject of reading. Typing is such a painless and interesting way to reinforce vocabulary.

Analyzing the test scores, one teacher observed:

> I feel that the first and fifth grade reading level did exceptionally well. The third level has improved 100 per cent, but I doubt that the tests will show this. The children are characteristically test shy.

Another teacher remarked: "Regardless of test results, the value of the program has been beyond description."

One of the teachers summarized what she considered to be significant nonmeasurable results of the typewriting program:

1. Awareness of the distinction between letters in words, particularly those with similar configurations
2. Awareness of articles in sentences
3. Concentration on the sounds of letters when reading orally
4. Recognition of capital letters at the beginning of sentences, which may have resulted from the use of the shift key
5. Desire to be accurate
6. Attention to spacing between words
7. Satisfaction in receiving immediate reward (strike a key, see a letter)
8. Improvement of left to right eye movement
9. Increase in attention and memory span
10. Desire to continue typewriting

Other Reactions.--Nonparticipating teachers in the Special Education Program of the Archdiocese of St. Louis, Missouri, expressed a desire to participate in the typewriting program, if possible.

Student teachers from Fontbonne College, St. Louis, Missouri, observed the typewriting program in some of the special education classes. Their supervising teacher wrote: "They [student teachers] were quite interested and delighted with the project."

Visitors frequently observed the typewriting program. The following comments were made in this respect by the teachers:

"Many people visit our class. They are intrigued."

"The children are proud to have visitors come in and watch them at work."

"The class is the envy of others in the school. In fact, nearly every morning, a small group comes in to watch someone type."

"Visitors to the classroom show a great deal of interest and are anxious to hear the results of the study."

Several schools exhibited the typewriting papers in the corridors of their schools for visitors to observe during Open House.

A social organization sponsored a benefit dance to provide funds for one of the schools to purchase some of the typewriters.

Progress Records

Participating teachers were requested to maintain progress records on which were reported pupils' responses, teachers' reactions, problems, and suggestions for overcoming minor difficulties. See Appendix H, page 163, for samples of the progress records. Reports from these records were discussed at the following conferences, held at Fontbonne College, St. Louis, Missouri: October 23, 1969, approximately six weeks after the

beginning of the study; and December 21, 1969, approximately the mid-point of the program. On October 23, 1969, the report was based on phase one of the investigation: preliminary typewriting; on December 21, 1969, the report was based on phase two: language arts typewriting. A summary of reports on the following topics is contained in this section: materials, typewriters, problems, color-coding devices, and teacher aides. The questions relative to pupil and parental attitudes were treated in Section 2 of this chapter, "Attitudes Toward Typewriting for the Educable Mentally Handicapped."

In answer to the question, "What problems have you experienced with the materials?", six of the nine participating teachers indicated "none" on the October report. On the December report, five teachers reported that several stories in the third grade reader did not correspond with the programmed materials.

It was discovered that the third grade readers in five of the participating classes contained several stories which were different from those on which the typewriting materials were based. This occurred in spite of the fact that the same edition of the reader was used for the preparation of the materials. The Houghton-Mifflin Book Company promptly replaced the readers with those corresponding to the materials.

The following comments were made by the participating teachers with respect to the materials for preliminary typewriting: "The children seem to follow the directions with ease." "I am doubtful whether the children look at the chart on their papers. It appears that the colored tape on the keys is sufficient to call their attention to correct finger location."

In Table 14, below, responses are categorized according to a general classification.

TABLE 14

PROBLEMS TEACHERS EXPERIENCED WITH THE MATERIALS

General Classification Responses	Number of Teachers
October Report	
No Problems	6
Insufficient amount of material	3
Difficulty distinguishing between similar words	1
December Report	
Incorrect reader for third grade	5
No problems	4

Table 15, page 107, summarizes the teachers' reactions to the format of the materials. The teachers were unanimous in responding that the format of the preliminary typewriting material was satisfactory. However, they reported that, although the programmed aspect of the material designed for language arts was effective for the experimental group because the typewriter platen covered the correct answers until the carriage was returned, it was only partially effective for the pupils in the control group. Pupils in the control group frequently glanced at the correct responses on their sheets before filling in their answers, even though heavy colored paper was provided to cover the answers until they were to be checked. This did not seem to present a serious problem, as one of the special education teachers affirmed:

TABLE 15

TEACHER REACTION TO FORMAT OF MATERIALS

General Classification Responses	Number of Teachers
October Report	
Very Good	9
December Report	
Programmed aspect ineffective for control group	3
Lines needed for the exercises for control group	3
Additional space needed for exercises for control group	3

> I feel that nothing is being lost because of this. With retarded children, many exposures are needed. . . . There is an advantage to having a correct image for the children to see immediately.

"What problems have you experienced with the typewriters?" revealed the answers presented in Table 16, page 108. Two unsuccessful attempts were made to steal the electric typewriters from one of the classrooms. To maximize the security of the typewriters, the doors were equipped with additional locks and the local police were notified with the request that additional protection be provided for the school. One of the special education classes in an inner city school was relocated to the second floor of the school to insure greater safety for the machines. In spite of the precautions which were taken to protect the typewriters, on January 10 or 11, 1970, the extra electric typewriter which was being stored in the office of the Director of the Special Education Program was stolen, along with equipment from other offices in the building.

TABLE 16

PROBLEMS EXPERIENCED WITH TYPEWRITERS

General Classification Responses	Number of Teachers
October Report	
No Problems	5
Return key needed repair	2
Keys were stiff	2
December Report	
No Problems	6
Fear of theft	4
Alignment	1
Spacing	1

Table 17, page 109, presents suggestions offered to remedy difficulties experienced with the materials. One teacher recommended that the directions be taped so that the pupils could listen to them, as well as read them. Table 18, page 110, indicates the suggestions to remedy problems experienced with the typewriters. A teacher who experienced minor difficulty in introducing the keyboard recommended that nylon gloves be provided for the pupils, with names of the typewriter keys printed on the fingers.

In response to the question, "Do you have enough material for each day's lesson?", five teachers answered affirmatively on the October report, eight answered affirmatively on the December report. (See Table 19, page 110)

TABLE 17

SUGGESTIONS TO REMEDY PROBLEMS EXPERIENCED WITH MATERIALS

General Classification Responses	Number of Teachers
October Report	
No suggestions	5
Provide additional materials	1
Shorten typewriting period	1
Decrease amount of vocabulary reinforcement	1
December Report	
No suggestions	6
Draw lines on materials to be used by control group	3
Provide additional space on materials to be used by control group	2

As the subjects in the experimental group gained proficiency in their modified touch typewriting skill, they were able to cover materials in addition to those provided for the study during the 45-minute instructional period. Supplementary work included letters, compositions, lists of spelling words, and sentences using the spelling words. Some pupils typed their Christmas cards and other greeting cards. See Appendix U, page 242, for unedited samples of the pupils' supplementary typewriting work.

The participating teachers were asked whether they altered the materials, and if so, how. Their responses are found on Table 20, page 111.

TABLE 18

SUGGESTIONS TO REMEDY PROBLEMS EXPERIENCED WITH TYPEWRITERS

General Classification Responses	Number of Teachers
October Report	
No suggestions	8
Provide nylon gloves with names of typewriter keys printed on fingers	1
December Report	
No suggestions	8
Reteach keyboard, using traditional motivational devices, such as point systems and progress charts	1

TABLE 19

ADEQUACY OF MATERIAL FOR EACH DAY'S LESSON

Response	Number of Teachers
October Report	
Yes	5
No	3
No comment	1
December Report	
Yes	8
Ordinarily	1

TABLE 20

EXTENT OF ALTERATION OF MATERIALS

General Classification Response	Number of Teachers
October Report	
No alteration	9
December Report	
Drew lines on materials for control group	7
Required pupils at fifth grade level to alphabetize vocabulary words for variety	1

"Have you used the device of coloring the keys on the keyboard of the book, Typing Fun, as each new key is introduced?" was answered as reported in Table 21, page 112. Those who did not color the keyboards as the new keys were introduced stated that their students found the use of the chart above each day's work sheet sufficient without color to aid in the location of the new keys.

In response to the question, "What has been the pupils' reaction to the colored plastic rings? How long were they used?", the teachers all reported that the pupils found them inconvenient for typewriting. The pupils stopped wearing the rings after a brief period of time, ranging from one day to two weeks. Some of the comments were: "The children found them awkward and bothersome. They preferred to use the chart for reference." "The plastic rings were uncomfortable . . . we used them only during the first week." Table 22, page 112, indicates the length of time the classes used the colored plastic rings which were designed to assist

TABLE 21

RESPONSE CONCERNING WHETHER THE DEVICE OF COLORING THE KEYS ON THE KEYBOARD OF THE BOOK, TYPING FUN, WAS USED AS EACH NEW KEY IS INTRODUCED

Response	Number of Teachers
Yes	3
For the first week	3
No	2
For the first five weeks	1

TABLE 22

LENGTH OF TIME THE COLORED PLASTIC RINGS WERE USED

Response	Number of Teachers
One day	4
One week	2
Two days	1
Three days	1
Two weeks	1

the pupils in using the correct fingers for typewriting, by associating the colors on the rings with the color-coded typewriter keys.

The question was posed: "What has been the reaction to the colored tape on the typewriter keys? Has it helped the pupils to use the correct fingers on the keys?" General classification responses are given in Table 23, page 113.

TABLE 23

REACTION TO THE COLORED TAPE
ON THE TYPEWRITER KEYS

General Classification Response	Number of Teachers
Color cues have been beneficial	6
After the first week, color cues were unnecessary	2
No comment	1

Table 24, below, presents the number of teacher aides who were employed specifically to assist the teachers during the typewriting program. It can be noted that only two of the nine participating teachers were assisted by teacher aides.

TABLE 24

EMPLOYMENT OF A TEACHER AIDE TO ASSIST THE
TEACHER WHILE SHE TAUGHT TYPEWRITING

Response	Number of Teachers
No	7
Yes	2

Publicity

The following articles describing the typewriting project were published in local newspapers and nationally circulated news bulletins.

"Doctoral Student Aids Retarded with Typing." Grand Forks Herald,

January 28, 1970, page 15.

"Typewriting Therapy." St. Louis Globe-Democrat, December 22, 1969, page 13 A.

"Sister Conducts Research Teaching Retarded Through Typing." The Tower, St. Louis, Missouri, December, 1969, page 1.

"Influence of Typewriting on Retarded Studied." Alpha Nu News, University of North Dakota, Grand Forks, North Dakota, December, 1969, page 9.

"University to Study How Typewriting Can Help Mentally Retarded Students." The Provincial Newsletter, St. Louis, Missouri, December, 1969, page 6.

"Influence of Typewriting on Retarded Studied." Business Education News, University of North Dakota, November, 1969, page 10.

"Retarded Are Learning to Type." St. Louis Post-Dispatch, October 26, 1969, section D, page 4.

Chapter Summary

This chapter has presented and discussed the findings of this study with respect to the significance of the measurable and statistically immeasurable change resulting from treatment.

The statistical analysis of the data was presented as it related to the hypotheses which were tested. In summary, the statistical findings revealed the following:

1. Analysis of covariance was applied to the adjusted means for reading, yielding an F value of 1.52, which is statistically nonsignificant at the .05 level. However, the adjusted mean difference and the grade equivalent difference in reading favored the experimental group.

2. Analysis of covariance revealed that the F ratio for the adjusted means for vocabulary was .103 which is statistically non-significant.

3. The third hypothesis, which related to spelling, was tested by the analysis of covariance, which resulted in an F ratio of .79, which is nonsignificant. As in reading, the adjusted mean difference and the grade equivalent difference in spelling favored the experimental group.

4. Statistical significance was found in two of the motor development subtests, although the data revealed that the adjusted means of the experimental group exceeded those of the control group in ten (71 per cent) of the fourteen subtests.

5. The educable mentally handicapped in this study were able to achieve a modified touch typewriting skill as revealed by their straight-copy typewriting rate, which averaged twenty-three words per minute. This seemed to indicate that regular special education teachers can teach modified touch typewriting to the educable mentally handicapped without highly specialized preparation in typewriting methodology.

Attitudes toward typewriting for the educable mentally handicapped were revealed by progress records, case studies, pupils' letters, parents' letters, teachers' evaluations, and discussions at conferences. It was found that pupils whose lives had been characterized by frequent failure, academically, personally, and socially, achieved success in learning a modified system of touch typewriting. This success resulted in an enhancement of self-confidence which influenced their conduct and academic achievement.

Parents and teachers displayed a positive and enthusiastic attitude toward typewriting for the educable mentally handicapped.

Progress records, which were maintained by the participating teachers, reported pupils' responses, teachers' reactions, problems, and suggestions for overcoming minor difficulties. These records revealed that the specially designed programmed typewriting materials based on the linguistic approach seemed to be appropriate for teaching language arts typewriting.

Articles which described the typewriting project were published in local newspapers and in nationally circulated news bulletins.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATION

This chapter contains three sections: the first section summarizes the procedures and findings of this study; the second section presents conclusions derived from the findings; and the third section offers recommendations for implementation based on the findings, and recommendations for further study.

Summary

For many years, educators have been concerned with the problem of teaching reading, vocabulary, and spelling, as well as of improving the motor development of the educable mentally handicapped. Experience has demonstrated that these children learn more slowly and retain less than normal children under conventional classroom pedagogy.

The literature was searched for evidence of research concerning the influence of typewriting on the learning process and the motor development of the educable mentally handicapped. It was found that many studies have demonstrated that children with average or superior intelligence can develop their academic skills significantly through the use of the typewriter; however, few studies have investigated typewriting as a means of enhancing the learning process and the motor development of the educable mentally handicapped.

Only one study was found which was directly relevant to the present investigation. In 1960, Karnes, Clarizio, and Zehrbach conducted a study to

determine the influence of typewriting on the personality and achievement of the educable mentally handicapped through the use of a published curriculum. The findings revealed that only two of the seven tests significantly ($p=.05$) favored the experimental group: mechanics of language and arithmetic computation. Significance was not achieved in reading, spelling, and vocabulary. The study did not provide definite data concerning the educational value of the typewriter for the educable mentally handicapped.

No studies dealt with the influence of typewriting on motor development, nor with the use of specially prepared programmed typewriting instructional materials for the educable mentally handicapped.

The design of the present study was based on the psychological principles of learning which centered around the need for reinforcement of learning by the educable mentally handicapped. The problem of this study was to determine the influence of typewriting on selected language arts skills and motor development of the educable mentally handicapped. Specifically, an investigation was undertaken to determine the academic achievement of the educable mentally handicapped in reading, vocabulary, spelling, and of motor development resulting from the use of the typewriter and specially prepared programmed materials. The study also sought to investigate whether educable mentally handicapped children can learn a modified system of touch typewriting, and whether typewriting can be taught by regular special education teachers who have not had special preparation in typewriting methodology.

Literature germaine to the problem under investigation was studied in the areas of education, special education, business education, and abnormal psychology. A study of the literature enabled the investigator to develop an understanding of the characteristics of the educable

mentally handicapped, to determine effective pedagogical procedures for teaching the mentally handicapped, and to develop appropriate instructional materials.

Special programmed typewriting materials designed to supplement the language arts curriculum were developed according to the linguistic approach for this study. The investigator was assisted in the preparation of the materials by a reading and special education specialist, and by a typewriting specialist.

To realize the objective of this study, the Pretest-Posttest Control Group Design was employed. Sixty educable mentally handicapped pupils were selected from the population currently enrolled in the Special Education Program of the Archdiocese of St. Louis, Missouri: thirty were randomly assigned to the experimental group, thirty, to the control group. During the study, two subjects in the experimental group and two in the control group were eliminated from the investigation because of transferral from the program, or because of excessive absences. Fifty-six pupils completed the study.

Appropriate variables were controlled statistically by the application of analysis of covariance. The F-ratio revealed no significant difference between the experimental and control groups for the following variables: chronological age, mental age, intelligence quotient score, and educational achievement level.

The investigation was undertaken in nine special education classes in the Special Education Program of the Archdiocese of St. Louis, Missouri, for twenty-eight weeks during the fall and spring semesters, 1969-1970. The study was conducted in two phases: phase one was the first eight weeks, during which pupils were taught a modified system of touch typewriting by their

regular special education teacher; phase two was the period of the following twenty weeks, during which subjects participated in the language arts typewriting program.

Each group received forty-five minutes of instruction in the selected language arts skills daily, five days each week, in addition to their regular reading period. Subjects in the experimental group used standard electric typewriters to complete the programmed language arts exercises; subjects in the control group completed the exercises in the traditional manner; that is, by writing or printing with pencil or pen.

Four specialists in the field of typewriting or special education served as consultants for the study. A qualified psychometrist administered individually the Lincoln-Oseretsky Motor Development Scale.

The measuring instruments used in this study were: Metropolitan Achievement Test, Form A (pretest) and Form B (posttest); Lincoln-Oseretsky Motor Development Scale; and an adaptation of a straight-copy typewriting test published by the United Business Education Association.

The data derived from the measurement of pupils' performance on pretests and posttests were treated statistically through the use of analysis of covariance to determine the significance of change.

Attitudes toward the program of typewriting for the educable mentally handicapped were determined by means of an appraisal submitted by parents of subjects in the experimental group, evaluations of the participating teachers, discussions with the teachers at the conferences, letters from the pupils, and case studies.

The statistical findings as revealed through the use of analysis of covariance and the straight-copy typewriting test scores, together with unedited comments of the parents, teachers, and pupils, and excerpts

from the case studies which revealed attitudes toward the typewriting program were presented in Chapter IV, Findings.

This research was funded under Public Law 88-164, Title III, as amended, through the Division of Research, Bureau of Education for the Handicapped, United States Office of Education, Department of Health, Education, and Welfare.

In summary, the findings of this study were as follows:

A comparison of the adjusted means in posttest scores for reading and spelling revealed a gain in favor of the experimental group. However, neither of the gains was large enough to be statistically significant.

This finding is consistent with previous research by Durrell, Erickson, and Karnes, who found no significant difference in reading achievement. The subjects in the study by Durrell and by Erickson were of at least average intelligence, and the Karnes study was conducted over a period of two to three years.

Although Rowe reported a significant gain in vocabulary and reading for the experimental group in his investigation, his study dealt with typewriting for the gifted.

Hutt and Gibby, Ellis (1951), Frostig, and Smith (1968), among other educators of the mentally retarded, have stressed that one of the fundamental differences between retarded and normal children of the same age lies in the slowness and inefficiency with which they acquire knowledge and skills.

The scores obtained from the Metropolitan Achievement Test were converted to grade equivalents for the purpose of utility, since grade equivalents are often more meaningful to teachers than raw scores. The

experimental group gained an average of 5.1 months in reading; the control group, 3.7 months. There was a difference of 1.4 months (27 per cent) in favor of the experimental group.

The average intelligence quotient score of the subjects in the experimental group was 71; in the control group, 70. Johnson (1959) indicates that children with intelligence quotient scores of 70 develop intellectually at the rate of 70 per cent of the average or general population. Accordingly, the subjects in this study would be expected to advance 4.9 months during the seven months of instruction. The progress of the experimental group in reading, an average of 5.1 months, exceeded anticipated gains by .1 month; the control group lacked 1.2 months of achieving anticipated gains.

The experimental group exceeded the control group in spelling grade equivalents by an average of 1.1 months: the experimental group gained an average of 4.8 months, the control group, 3.7 months.

The adjusted means of posttest scores in vocabulary revealed a slight increase in favor of the control group. The mean gain in grade equivalents by the control group was 3.4 months in vocabulary; the experimental group gained an average of 2.8 months. The difference of .6 month favored the control group.

T tests of independent samples were applied to the scores of the matched pairs, which were divided into two groups: Group A (IQ 68-83), and Group B (IQ 52-67). (See Appendix P, page 188) There were no significant differences between the matched pairs of either group in reading, vocabulary, and spelling.

The experimental group performed significantly better than the control group in two of the Lincoln-Oseretsky Motor Development Scale

subtests: Touching Fingertips with Right Hand, and Tapping with the Left Hand. Although statistical significance was not found in the other motor subtests, the data revealed that the adjusted means of the experimental group exceeded those of the control group in ten of the fourteen subtests (71 per cent), and in the composite score of the motor subtests.

This finding appears to support Silvey's (1955) contention that the contribution which typewriting instruction can make to growth in muscular coordination may be the most valuable aspect of special training in typewriting for the mentally handicapped.

To determine whether the subjects in the experimental group were able to acquire a modified touch typewriting skill through the use of the specially designed programmed instructional materials, an adaptation of a straight-copy typewriting test published by the United Business Education Association was administered. The scores revealed that subjects typed an average of twenty-three gross words per minute, ranging from ten to thirty-four words per minute on a one-minute straight-copy typewriting test of new material. This rate compares favorably with first year typewriting standards which require normal high school students to type between twenty and thirty words per minute after one semester (usually sixteen weeks) of typewriting instruction.

Seventy-five per cent (twenty-one) of the subjects typed at least twenty words per minute; 25 per cent (seven) typed at least thirty words per minute. These scores reveal that the educable mentally handicapped were able to acquire a modified touch typewriting skill through the use of the specially prepared typewriting materials.

This finding is consistent with the research of Francis and Rarick, Tuttle, and Holman, which revealed that educable mentally handicapped

children have the capacity to learn simple sensory-motor skills, such as typewriting, as easily as normal children if given the opportunity.

Furthermore, it appears to confirm Hardaway's belief that intelligence quotient scores have little relation to typewriting success when judged by speed tests and manipulative process.

Tuttle found that the ability to follow directions had little significance with regard to the ability to learn typewriting. He reported that memory span as shown by the coefficient of correlation in his study had no direct relation to the ability to learn typewriting.

Johnson and Blake actually found that the retarded performed significantly better than normal children on simple motor tasks. As indirect evidence in support of this finding, Brace evaluated well-practiced athletic skills of mentally retarded girls and found a negligible correlation between motor ability and intelligence.

The results of the straight-copy typewriting test seems to indicate that educable mentally handicapped pupils can be taught a modified system of touch typewriting by regular special education teachers who have not had specialized preparation in typewriting methodology. This finding substantiates that of Artuso, Tootle, and Unzicker, who found that elementary school teachers who did not know how to type could teach typewriting to elementary school children by following the instructions for the materials.

For additional information, data were gathered relative to the handwriting rate of speed of subjects in the control group. It was found that the average handwriting rate of speed was sixteen words per minute, with a range of five to thirty-two words per minute. The average typewriting rate of speed of twenty-three words per minute exceeded the

handwriting rate of 30 per cent (seven words per minute).

To assist subjects in the use of the correct fingers for typewriting, the typewriter keys were color-coded with strips of colored mystic tape attached to the sides of the keys. The progress records indicated that two-thirds of the teachers found this means effective in developing correct finger control of the keys.

In this study of the influence of typewriting on academic achievement and motor development of the educable mentally handicapped, many intangible and statistically immeasurable findings were reported by teachers and parents, as well as by the pupils themselves. Among the psychological factors associated with this study, it was found that the positive attitudes toward typewriting were stronger than the aptitudes revealed by the statistical analysis of the data.

Attitudes toward the typewriting program were gleaned from progress records, which were kept by the teachers and discussed at the conferences; case studies of the subjects in the experimental group; letters from the parents; evaluations from the teachers; and letters from the pupils. These sources revealed that as a result of typewriting, subjects acquired greater self-confidence, independence, self-esteem, and experienced a feeling of accomplishment. In several instances, family acceptance of the retarded condition of the child was improved when the parents observed their child's achievement in typewriting.

School records indicated that approximately three-fourths of the subjects were in the lower third of the socioeconomic scale, as measured by the Prestige Occupational Scale (Hodges, Siegel, and Rossi). In this connection, Smith (1968, p. 5) notes that "an investigator who wishes to correlate social class with mental retardation may observe a moderately

high relationship between these two variables, perhaps on the order of .60 to .75." However, he emphasizes that, although factors characteristic of one's social class may influence to some extent the intellectual ability of an individual, it is important to bear in mind that "correlation does not necessarily mean causation" (p. 6).

Case studies revealed that some of the pupils came from broken homes, had little parental encouragement, suffered cultural deprivation, and had a history of failures: academic, personal, and social. Their achievement in typewriting provided some of the pupils with their first experience of success and accomplishment. It provided a strong incentive to achieve in other areas.

This finding reaffirms that of Moss, Heber (1957), and Gardner. Moss (p. 10) found in his study of failure-avoiding and success-striving behavior in mentally retarded and normal children that "a child whose behavior leads to success . . . develops a generalized expectancy that he will be able to continue making responses which will result in success."

Heber (1957) and Gardner found that for retarded children, success apparently contrasts with their previous history and spurs them to increase their efforts even more than it does for normal children, for whom success is common.

Subjects in the control group manifested mixed attitudes toward their role in the experimental study. Some were satisfied to participate in the program by completing the programmed exercises with pencil or pen; others were not satisfied, but persistently manifested a desire to learn to typewrite. Teachers revealed that toward the end of the study, some of the subjects who had been satisfied with their nontypewriting activities earlier in the study were becoming bored with the programmed exercises and

evinced an eagerness to learn to type. Although the teachers endeavored to motivate pupils in the control group and to create renewed interest in the work, a noticeable restlessness was evident among these pupils. This attitude, however, did not seem to affect adversely the performance of the subjects as revealed in the posttest scores of the measuring instruments.

Pupils who did not participate in the study were anxious to learn to typewrite. A common query heard by the teachers was: "Will we get to learn to type next year?"

Parents of the pupils in the experimental group expressed their attitude toward the typewriting program by means of an open form questionnaire which was sent to them by the individual special education teachers. Many of the parents had shown little or no previous interest in the activities of the school, according to the reports of the teachers. Their actions were characteristic of parents of the educable mentally handicapped, as described by Willey and Waite. It was observed by Willey and Waite (p. 208) that "parents of the mentally retarded child are characterized by their intense resistance to any realistic recognition of the limitations of capacities of their children; by their withdrawal from social activities."

Contrary to the description of Willey and Waite, parents of twenty-six of the twenty-eight subjects in the experimental group submitted an appraisal concerning the typewriting program. This was the first time some of the parents reacted to an activity of school. Almost all of the parents expressed a very positive attitude toward typewriting for their children, stating that they were pleased that their children were participating in the study, and indicating that they observed improvement in their children's conduct and educational achievement. Many expressed a desire that

the typewriting program would continue. One parent mentioned that there were no observable changes in his son's work.

Attitudes of the participating teachers were revealed by letters, discussions at conferences, private conversations, and evaluation reports submitted at the end of the study. Their general reaction was enthusiasm for the program, and personal satisfaction in the achievement of their subjects. Although some of the teachers were nontypists, by following the directions for the programmed typewriting instructional materials, they succeeded in teaching a modified touch typewriting skill to their pupils.

Illustrative of the attitude of the teachers toward the typewriting program was a comment made by one of them at the close of the study: "Regardless of the test results, the value of the program has been beyond description."

Nonparticipating teachers in the Special Education Program of the Archdiocese of St. Louis, Missouri, who were acquainted with the study, expressed an interest in typewriting for the educable mentally handicapped, and asked to participate in the program, if possible.

Progress records were maintained by the participating teachers concerning the materials and the typewriting activities. On these records were reported pupils' responses, teachers' reactions, problems, and suggestions for overcoming minor difficulties in the program. These reports were discussed at the conferences held during the experiment. Their contents may be of assistance in the validation of the materials for future studies.

In general, the reports indicated that the pupils responded favorably toward the programmed typewriting materials. Participating teachers

believed with Malpass (1968, p. 212) that "programmed instruction can provide relief from repetitive drill-type instruction to help the retardates acquire basic academic skills."

Articles which described the experimental study were published in the major local newspapers of Grand Forks, North Dakota, and St. Louis, Missouri; and in the publications of:

Delta Pi Epsilon, honorary graduate Business Education society
Business Education Department, University of North Dakota
St. Louis Province of the Sisters of St. Joseph of Carondelet
Congregational news of the Sisters of St. Joseph of Carondelet
Student newspaper, University of North Dakota

Conclusions

Within the limitations of this study, the following conclusions appear to be warranted:

1. The adjusted mean scores and the change in grade equivalents of the experimental group exceeded those of the control group in reading and spelling, although neither of these gains reached statistical significance. These findings appeared to indicate a trend whereby the use of the typewriter may contribute to the learning ability of the educable mentally handicapped in reading and spelling.

In view of the slowness and inefficiency with which the educable mentally handicapped acquire knowledge and skills, as demonstrated by Hutt and Gibby, Robert Ellis, Normal Ellis, Frostig, Smith (1968), and other specialists in the field of special education, one might anticipate that had the study been extended over a longer period of time, statistical significance may have been reached in reading and spelling in favor of the experimental group.

2. Statistical significance was not found in analyzing the post-test scores for vocabulary. There were no observable trends in favor of the experimental group for this subject.

3. Typewriting seemed to enhance the motor ability of the educable mentally handicapped as revealed by the adjusted means of ten (71 per cent) of the fourteen motor subtests, and the composite score of the subtests. On these tests, the performance of the experimental group exceeded that of the control group. Although statistical significance was achieved in only two of these subtests, a trend in favor of the experimental group may be detected in the raw scores.

4. The results of the straight-copy typewriting test administered to the subjects in the experimental group demonstrated that the educable mentally handicapped were able to acquire a modified touch typewriting skill through the use of the specially prepared programmed typewriting materials.

5. The fact that 75 per cent (twenty-one) of the subjects in the experimental group typed at least twenty words per minute, and 25 per cent (seven) typed at least thirty words per minute seemed to indicate that the majority of the subjects in the experimental group had the aptitude to acquire a usable typewriting skill. With additional instruction and practice, they may have the potential to achieve skill in typewriting to the extent that they may be able to obtain employment performing such simple routine tasks as addressing envelopes, typewriting labels, and similar copy work.

6. Regular special education teachers who have not had highly specialized preparation in typewriting methodology can teach educable mentally handicapped children a modified touch typewriting skill by following

the directions for the typewriting instructional materials.

7. Color-coded typewriting keys seemed to be effective in assisting subjects to acquire correct finger location for typewriting.

8. The psychological results of this study: pupils' experience of success, greater self-confidence, independence, self-esteem, and sense of achievement, together with high student interest in typewriting, seemed to indicate a valuable potential in typewriting for the educable mentally handicapped.

9. The inclusion of typewriting as a regular part of the special education curriculum appears to be justified on the basis of the following:

   a. The positive, although not statistically significant, findings in reading, spelling, and the majority of the motor development subtests

   b. The statistically nonmeasurable psychological benefits of typewriting for the educable mentally handicapped

   c. The ability of regular special education teachers to teach a modified touch typewriting skill without special preparation in typewriting methodology

10. It appears plausible to assume from the responses of the participating teachers that programmed instructional typewriting materials based on the linguistic approach are appropriate for teaching language arts typewriting.

11. The results of this investigation may provide evidence which partially answers the need for a solution to the problem of teaching language arts skills, of improving motor development, and of providing prevocational preparation for the educable mentally handicapped.

Recommendations

Based on the statistical and psychological findings of this investigation, the following recommendations are made for implementation and for further study:

Recommendations for Implementation

1. It is recommended that typewriting be incorporated as a part of the regular special education curriculum on the basis of the following findings:

   a. The positive, although not statistically significant, findings in reading, spelling, and the majority of the motor development subtests

   b. The statistically nonmeasurable psychological benefits of typewriting for the educable mentally handicapped

   c. The ability of regular special education teachers to teach a modified touch typewriting skill without special preparation in typewriting methodology

2. The specially designed programmed typewriting materials based on the linguistic approach appear to be appropriate for teaching language arts typewriting. Therefore, it is recommended that materials such as these be used in a language arts typewriting program for the educable mentally handicapped.

3. Prevocational typewriting should be taught to those educable mentally handicapped pupils who seem to have the aptitude for learning to typewrite. Although these students do not usually have the intellectual potential to become secretaries or stenographers, even with intensive training, with sufficient instruction and practice, they can learn the skill of typewriting to the extent that they may be able to perform such simple routine tasks as addressing envelopes, typing labels, and similar copy work.

4. Since educable mentally handicapped pupils frequently have poor motor coordination, it is recommended that standard electric typewriters be used to teach them typewriting because of the ease with which the typewriter keys can be activated.

Recommendations for Further Research

1. Before the recommendations given as a result of the findings of research can be generally accepted, it is necessary that the study be cross-validated. Therefore, it is recommended that the present investigation be replicated.

2. Normative data should be established in the area of teaching the educable mentally handicapped through the use of the typewriter. A basis for this data has been provided by this investigation. However, a broader base from which samples are drawn, together with a larger sample would provide for the validation of these norms.

3. This study deals with groups of three or four in the language arts typewriting classes. Research should be undertaken to test the effectiveness of typewriting with groups of various sizes larger than three or four.

4. The language arts typewriting materials prepared for this study have been adapted from a reading series currently in use in the Special Education Program of the Archdiocese of St. Louis, Missouri. The possibility of developing typewriting materials for remedial programs should be researched.

5. The experimental classes were conducted for forty-five minutes daily, five days a week, for twenty-eight weeks. Further research of the use of the typewriter with the educable mentally handicapped should take

into account both aspects of treatment time--length of lesson and length of program. It is possible that length of treatment time is an important variable that will require further attention.

6. Subjects for this study were confined to the educable limits as defined by the American Association on Mental Deficiency; that is, those with intelligence quotient scores ranging from fifty-five to eighty-four. Those who had observable indications of sensory-motor impairment, as well as other special clinical types, were not included in this study. Further research in this area should be extended to include pupils with the following handicaps:

a. The trainable mentally handicapped

b. The emotionally disturbed

c. Those with major learning disabilities

d. The socially maladjusted

e. Those with physical handicaps

f. The cerebral palsied

7. The present investigation was a determination of the influence of typewriting on selected language arts skills and motor development of the educable mentally handicapped. Additional research of typewriting for the handicapped should be undertaken to include the following areas:

a. Arithmetic concepts and problem solving

b. The use of the typewriter as a tool of literacy

c. The use of the Peabody Kit

8. Artuso conducted a study of the motivational aspect of typewriting for normal children at the fourth, fifth, and sixth grade levels. However, there have been no studies of the motivational influence of the typewriter on the educable mentally handicapped. Therefore, it is

recommended that further study be conducted to investigate the motivational influence of the typewriter on the educable mentally handicapped.

9. Experimental studies of comparative educational techniques for the educable mentally handicapped are almost nonexistent. It is recommended that an investigation be undertaken to determine the influence of typewriting as compared to the ten-key adding machine on the learning process of the educable mentally handicapped.

10. A fruitful area of research would seem to lie in measuring the influence of typewriting on the educable mentally handicapped through the use of these additional instruments:

a. Wechsler Intelligence Scale for Children (WISC), which provides a verbal and a performance score.

b. Illinois Test of Psycholinguistic Abilities (ITPA), which covers behaviors involved in three processes of communication (decoding, association, and encoding), different levels of language organization (representational versus automatic-sequential), and the channels of language input and output.

c. Peabody Picture Vocabulary Test (PPVT), which is designed to measure the child's ability to recognize the spoken word.

d. Vineland Social Maturity Scale, which was developed to measure adaptive behavior of the educable mentally handicapped.

e. Marianne Frostig Developmental Test of Visual Perception, which was developed by Frostig for the purpose of evaluating perceptual disturbances of normal and neurologically handicapped children.

11. Based on Fernald's hypothesis that the approach to more effective visual learning is through the tactile-auditory modalities, an experimental investigation should be conducted to determine the influence of vocalization while words are being typed on the learning process of the educable mentally handicapped.

12. Further research is recommended in which nonparametric statistical tests are employed in the analysis of the data.